

MAILBOX ASSEMBLY AND METHOD FOR AUTOMATED RELEASE OF MAIL ITEMS

Cross Reference to Related Application(s)

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The present disclosure claims the benefit of Singapore Patent Application No. 10202111463Y filed on 15 October 2021, which is incorporated in its entirety by reference herein.

10 Technical Field

The present disclosure generally relates to a mailbox assembly for automated release of mail items and a method of performing the same.

15 Background

Currently, mail items including letters and packages are usually manually sorted and packed according to size and destination. Many countries have provided mailboxes for each residential / commercial unit to receive mail items, particularly ordinary mail, to improve efficiency of mail deliveries. Due to the increasing number of high-rise and densely populated buildings, a bank of mailboxes is normally installed at accessible ground or lower level floors to support some of these mail deliveries.

One problem is the time taken by a mail carrier (e.g. postman) to sort and deposit the mail items to the respective mailboxes according to the mailing addresses. For example, for a high-rise building with a large number of residential units, the mail carrier needs to spend a significant amount of time for mail sorting and depositing into the mailboxes. The time taken further increases if the mail carrier also needs to perform doorstep delivery of registered mail. Given the time taken for each building and the number of buildings assigned to the mail carrier, the margin of error in delivery widens as the mail carrier could make mistakes, such as incorrect sorting and depositing into the wrong mailboxes.

Additionally, some companies such as courier and e-commerce companies may require acknowledgements from the recipients after delivering certain types of mail items like registered mail and large parcels, but they do not get such acknowledgements from the recipients. It would be a significant cost for such companies to request such acknowledgements given the high volume of ordinary mail and the low revenue from delivering ordinary mail. Even for the lower volume of registered mail, it is also challenging to get acknowledgements because both the mail carrier and recipient must be present during delivery.

Another problem is that a typical mailbox has a fixed number and size of storage units and each storage unit is allocated to a household. The mailbox with N storage units can only serve up to N households at any one time. Some storage units may contain large packages while some may contain only a few letters, resulting in large empty wasted spaces in the mailbox.

Therefore, there is a need to provide an improved mailbox assembly to address or alleviate at least one of the aforementioned problems and/or disadvantages.

Summary

According to a first aspect of the present disclosure, there is a mailbox assembly for automated release of mail items, the mailbox assembly comprising:

- a plurality of storage units for receiving a plurality of mail units, each mail unit comprising an identifier label and a plurality of partitions, each partition comprising one or more mail items addressed to a mailing address associated with the respective partition;

- a collection unit configured to move to each storage unit to receive the mail items from the respective storage unit;

- an actuation mechanism configured to move to each storage unit to displace the mail items in one or more partitions of the respective mail unit into the collection unit;

- a scanning system for scanning the identifier labels of the mail units; and

- a control module configured for:

receiving address data of each partition of each mail unit, the address data comprising the mailing addresses associated with the partitions;

matching the scanned identifier labels against the address data to determine the mailing address associated with each partition of each mail unit in the storage units;

identifying one or more partitions associated with the mailing address of a user collecting the mail items addressed to the user's mailing address; and

controlling movement of the collection unit and actuation mechanism to displace the mail items in the identified partitions into the collection unit for collection by the user.

According to a second aspect of the present disclosure, there is a method for automated release of mail items, the method comprising:

receiving a plurality of mail units in a plurality of storage units, each mail unit comprising an identifier label and a plurality of partitions, each partition comprising one or more mail items addressed to a mailing address associated with the respective partition;

scanning the identifier labels of the mail units in the storage units;

receiving address data of each partition of each mail unit, the address data comprising the mailing addresses associated with the partitions;

matching the scanned identifier labels against the address data to determine the mailing address associated with each partition of each mail unit in the storage units;

identifying one or more partitions associated with the mailing address of a user collecting the mail items addressed to the user's mailing address;

moving a collection unit and an actuation mechanism to a storage unit comprising the identified partitions; and

displacing, using the actuation mechanism, the mail items in the identified partitions into the collection unit for collection by the user.

A mailbox assembly and a method for automated release of mail items according to the present disclosure are thus disclosed herein. Various features, aspects, and

advantages of the present disclosure will become more apparent from the following detailed description of the embodiments of the present disclosure, by way of non-limiting examples only, along with the accompanying drawings.

5 **Brief Description of the Drawings**

Figures 1A to 1E are illustrations of a mailbox assembly for automated release of mail items.

10 Figures 2A and 2B are illustrations of a mail unit for the mailbox assembly.

Figures 3A and 3B are illustrations of a carrier unit for the mail unit.

Figures 4A and 4B are illustrations of a collection unit of the mailbox assembly.

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Figures 5A and 5B are illustrations of an actuation mechanism of the mailbox assembly.

Figure 6 is a flowchart illustration of a method for automated release of mail items.

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Figure 7 is an illustration of a system comprising the mailbox assembly for automated release of mail items.

Figure 8 is an illustration of a process for automated release of mail items in the mailbox assembly.

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Detailed Description

For purposes of brevity and clarity, descriptions of embodiments of the present disclosure are directed to a mailbox assembly and a method for automated release of mail items, in accordance with the drawings. While aspects of the present disclosure will be described in conjunction with the embodiments provided herein, it will be understood that they are not intended to limit the present disclosure to these

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embodiments. On the contrary, the present disclosure is intended to cover alternatives, modifications and equivalents to the embodiments described herein, which are included within the scope of the present disclosure as defined by the appended claims. Furthermore, in the following detailed description, specific details
5 are set forth in order to provide a thorough understanding of the present disclosure. However, it will be recognized by an individual having ordinary skill in the art, i.e. a skilled person, that the present disclosure may be practiced without specific details, and/or with multiple details arising from combinations of aspects of particular embodiments. In a number of instances, well-known systems, methods, procedures,
10 and components have not been described in detail so as to not unnecessarily obscure aspects of the embodiments of the present disclosure.

In embodiments of the present disclosure, depiction of a given element or consideration or use of a particular element number in a particular figure or a
15 reference thereto in corresponding descriptive material can encompass the same, an equivalent, or an analogous element or element number identified in another figure or descriptive material associated therewith.

References to “an embodiment / example”, “another embodiment / example”, “some
20 embodiments / examples”, “some other embodiments / examples”, and so on, indicate that the embodiment(s) / example(s) so described may include a particular feature, structure, characteristic, property, element, or limitation, but that not every embodiment / example necessarily includes that particular feature, structure, characteristic, property, element or limitation. Furthermore, repeated use of the
25 phrase “in an embodiment / example” or “in another embodiment / example” does not necessarily refer to the same embodiment / example.

The terms “comprising”, “including”, “having”, and the like do not exclude the presence of other features / elements / steps than those listed in an embodiment.
30 Recitation of certain features / elements / steps in mutually different embodiments does not indicate that a combination of these features / elements / steps cannot be used in an embodiment.

As used herein, the terms “a” and “an” are defined as one or more than one. The use of “/” in a figure or associated text is understood to mean “and/or” unless otherwise indicated. The term “set” is defined as a non-empty finite organisation of elements that mathematically exhibits a cardinality of at least one (e.g. a set as defined herein
5 can correspond to a unit, singlet, or single-element set, or a multiple-element set), in accordance with known mathematical definitions. The terms “first”, “second”, etc. are used merely as labels or identifiers and are not intended to impose numerical requirements on their associated terms.

10 In representative or exemplary embodiments of the present disclosure, with reference to Figures 1A to 1E, there is a mailbox assembly 100 for automated release of mail items. These mail items may be in various shapes and sizes. Some non-limiting examples of mail items include letters, envelopes, packets, packages, parcels, publications, postcards, greeting cards, and the like. These mail items are
15 normally delivered by a mail carrier from a central postal location or mail distribution centre to the mailbox assembly 100. The mailbox assembly 100 is usually located at the ground or lower levels of buildings housing several units, such as residential households and/or commercial offices.

20 The mailbox assembly 100 is configured to receive a plurality of mail units 200. As shown in Figures 2A and 2B, these mail units 200 may be referred to as magazines that contain a number of one or more mail items 210. Each mail unit 200 includes a plurality of partitions 220, and each partition 220 includes one or more mail items 210 addressed to a mailing address associated with the respective partition 220. The
25 mail items 210 are sorted into the partitions 220 before the mail units 200 are delivered to the mailbox assembly 100. For example, the mail items 200 are sorted into the partitions 220 at the central postal location or mail distribution centre where the mail units 200 originate from.

30 Each mail unit 200 includes a body frame 222 with handles 224 for the mail carrier to handle the mail unit 200. The partitions 220 are formed by partition members 226 that can be inserted into the body frame 222 are suitable gaps depending on the sizes of the mail items 210. The body frame 222 may have a series of slots or

receptacles to selectably receive the partition members 226, resulting in configurable space sizes for different mail items 210 of various shapes and sizes.

A mail unit 200 can be loaded with different sized mail items 210 addressed to different mail addresses of different users. The mail items 210 for a user mailing address can be distributed across one or more partitions 220 in one mail unit 200, or across partitions 220 in multiple mail units 200. For example, the mail items 210 can be spread across non-contiguous partitions 220 of a single mail unit 200. This can facilitate optimization of the limited storage space provided by the mail units 200.

Each mail unit 200 includes an identifier label that identifies the particular mail unit 200. Optionally, each partition 220 of the mail unit 200 may include a partition label that identifies the particular partition 220, for example to determine the size of the partition 220. The identifier labels and partition labels may include machine-readable optical code, such as a 2D code (e.g. QR code or data matrix code) or 1D barcode.

As shown in Figures 3A and 3B, the mail carrier may carry the mail units 200 in a carrier unit 250 during transportation to the mailbox assembly 100. The carrier unit 250 includes a body frame 252 for holding the mail units 200, and a set of handles 254 for ease of carrying. The body frame 252 may include suitable structures to secure the mail units 200 and to prevent them from sliding out during transportation.

As shown in Figures 1A to 1F, the mailbox assembly 100 includes a plurality of storage units 110 for receiving the mail units 200. More specifically, when the mail carrier arrives at the mailbox assembly 100, the mail carrier delivers a batch of mail units 200 containing the mail items 210 into the storage units 110. For example, each mail unit 200 is loaded into a respective one of the storage units 110. The storage units 110 may be arranged in an array in the back portion 102 of the mailbox assembly 100.

In some embodiments, the storage units 110 may be divided into upper and lower portions of the mailbox assembly 100. The storage units 110 at the upper portion may be designated to receive the mail units 200 that contain mail items 210 such as

letters. The storage units 110 at the lower portion may be designated to receive individual mail items 210 that are larger in size or irregular in shape, such as large packages.

5 The mailbox assembly 100 includes a collection unit 120 configured to move to each storage unit 110 to receive the mail items 210 from the respective storage unit 110. The mailbox assembly 100 includes an actuation mechanism 130 configured to move to each storage unit 110 to displace the mail items 210 in one or more partitions 220 of the respective mail unit 200 into the collection unit 120. For example,
10 after the actuation mechanism 130 has moved to the storage unit 110, the actuation mechanism 130 displaces or pushes the mail items 210 in the partitions 220 into the collection unit 120. The mailbox assembly 100 may include a collection window 122 at the front portion 104 of the mailbox assembly 100. After the collection unit 120 has received the mail items 210, the collection unit 120 moves to the collection window
15 122 where a user is able to access the collection unit 120 to retrieve the mail items 210.

Figures 4A and 4B show exemplary illustrations of the collection unit 120 that is configured to move in front of the storage units 110 to receive the mail items 210.
20 For example, the collection unit 120 is coupled to suitable guides 124 that are configured to move the collection unit 120 bi-directionally or planarly.

Figures 5A and 5B show exemplary illustrations of the actuation mechanism 130 that is configured to move behind the storage units 110, such that the mail items 210 can
25 be displaced forward into the collection unit 120 in front. For example, the actuation mechanism 130 is coupled to suitable guides 132 that are configured to move the actuation mechanism 130 bi-directionally or planarly. Additionally, the actuation mechanism 130 includes an actuator 134 that is configured to actuate or push the mail items 210 in the partitions 220 forward towards the collection unit 120. The
30 actuator 134 may be adjustable, such as to adjust its width, to fit into the partitions 220 which may have different widths. This facilitates the displacement of mail items 210 in the partitions 220 into the collection unit 120. For example, adjusting the

actuator 134 to fit a partition 220 with a wider width ensures that all the mail items 210 in the partition 220 are displaced into the collection unit 120.

5 The mailbox assembly 100 includes a scanning system for scanning the identifier labels of the mail units 200 in the storage units 110. The scanning system includes a set of one or more imaging devices, such as a camera or image capture device, that can read machine-readable optical code such as the identifier labels of the mail units 200. In some embodiments, the one or more imaging devices are moveable within the mailbox assembly 100 to scan the identifier labels of the mail units 200 loaded in
10 different storage units 110. Additionally or alternatively, the scanning system includes a plurality of imaging devices that correspond to the storage units 110, such that each storage unit 110 has an imaging device for reading the identifier label of the mail unit 200 loaded in the respective storage unit 110.

15 The mailbox assembly 100 includes a control module configured for receiving, such as from a remote server, address data of each partition 220 of each mail unit 200, the address data including the mailing addresses associated with the partitions 220. Notably, each partition 220 is associated with one mailing address such that all the mail items 210 in that partition 220 are addressed to a specific mailing address. The
20 remote server may be located at the central postal location or mail distribution centre where the mail items 210 are sorted into the partitions 220 of the mail units 200 based on their mailing addresses. The address data may be sent from the remote server after the mail items 210 have been sorted and placed into the mail units 200. Alternatively, the control module may request and retrieve the address data from the
25 remote server on demand.

The control module is further configured for matching the scanned identifier labels against the address data to determine the mailing address associated with each partition 220 of each mail unit 200 in the storage units 110. More specifically, after
30 the mail items 210 have been sorted into the partitions 220 of the mail units 200, the mailing addresses associated with each partition 220 is recorded on the remote server. Each mail unit 200 can be identified using its identifier label and the mailing addresses associated with all the partitions 220 of the respective mail unit 200 can

be determined. After the mail units 200 are loaded by the mail carrier into the storage units 110, the identifier labels of each mail unit 200 are scanned using the scanning system. The control module matches the scanned identifier labels against the addresses details to determine the mailing address associated with each partition

220.

The control module is further configured for identifying one or more partitions 220 associated with the mailing address of the user collecting the mail items 210 addressed to the user's mailing address. For example, during collection, the user inputs a user identifier to the mailbox assembly 100 and the control module can determine the user's mailing address based on the user identifier. Since the mailing addresses of all the mail units 200 in the storage units 110 are known, the control module can determine the one or more partitions 220 that are associated with the user's mailing address.

The control module is further configured for identifying one or more partitions 220 controlling movement of the collection unit 120 and actuation mechanism 130 to displace the mail items 210 in the identified partitions 220 into the collection unit 120 for collection by the user. In one example, all the identified partitions 220 are in one mail unit 200. The collection unit 120 and actuation mechanism 130 moves to the storage unit 110 holding the mail unit 200. The actuation mechanism 130 then pushes the mail items 210 in the identified partitions 220 into the collection unit 120. In another example, the identified partitions 220 are in multiple mail units 200. The collection unit 120 and actuation mechanism 130 moves to the first storage unit 110 to collect the mail items 210 from the first mail unit 200, and then to the second storage unit 110 to collect the mail items 210 from the second mail unit 200, and so forth. After the collection unit 120 has collected all the mail items 210, the collection unit 120 may move to the collection window 122 where the user can retrieve the mail items 210.

In various embodiments of the present disclosure, with reference to Figure 6, there is a method 300 for automated release of mail items 210, such as using the mailbox assembly 100 or any other suitable mailbox or letterbox. The method 300 includes a

step 302 of receiving a plurality of mail units 200 in a plurality of storage units 110, each mail unit 200 including an identifier label and a plurality of partitions 220, each partition 220 including one or more mail items 210 addressed to a mailing address associated with the respective partition 220. The method 300 includes a step 304 of

5 scanning the identifier labels of the mail units 200.

The method 300 includes a step 306 of receiving, from the remote server, address data of each partition 220 of each mail unit 200, the address data including the mailing addresses associated with the partitions 220. The method 300 includes a
10 step 308 of matching the scanned identifier labels against the address data to determine the mailing address associated with each partition 220 of each mail unit 200 in the storage units 110. The method 300 includes a step 310 of identifying one or more partitions 220 associated with the mailing address of the user collecting the mail items 210 addressed to the user's mailing address. The method 300 includes a
15 step 312 of moving the collection unit 120 and the actuation mechanism 130 to a storage unit 110 having the identified partitions 220. The method 300 includes a step 314 of displacing, using the actuation mechanism 130, the mail items 210 in the identified partitions 220 into the collection unit 120 for collection by the user. Notably, if the identified partitions 220 are in multiple mail units 200, the steps 312 and 314
20 includes moving the collection unit 120 and the actuation mechanism 130 to the respective storage units 110 holding the multiple mail units 200 and displacing the mail items 210 in those mail units 200.

In various embodiments of the present disclosure, with reference to Figure 7, there is
25 a system 400 for automated release of mail items 210 in mailbox assemblies 100. The system 400 includes a set of one or more mailbox assemblies 100 and the remote server 410 that is communicative with the mailbox assemblies 100. The system 400 further includes a set of one or more user electronic devices 420 that are used by users or recipients to collect the mail items 210 from the mailbox assemblies
30 100. The system 400 further includes a communication network 430 for communication among the mailbox assemblies 100, remote server 410, and user electronic devices 420.

The communication network 430 is a medium or environment through which content, notifications, and/or messages are communicated among various components. Suitable security protocols, such as encryption protocols, may be implemented in the communication network 430 for secure communications among the components.

5 Some non-limiting examples of the communication network 430 include a virtual private network (VPN), wireless fidelity (Wi-Fi) network, light fidelity (Li-Fi) network, local area network (LAN), wide area network (WAN), metropolitan area network (MAN), satellite network, Internet, fibre optic network, coaxial cable network, infrared (IR) network, radio frequency (RF) network, and any combination thereof. Various
10 components in the communication network 430 may connect to the communication network 430 in accordance with various wired and wireless communication protocols, such as Transmission Control Protocol / Internet Protocol (TCP/IP), User Datagram Protocol (UDP), 2nd to 5th Generation (2G to 5G) communication protocols, Long Term Evolution (LTE) communication protocols, and any combination thereof. Each
15 component to the communication network 430 includes a data communication or transceiver module to communicate and transmit / receive data over the communication network 430. Some non-limiting examples of a transceiver module include an antenna module, a radio frequency transceiver module, a wireless transceiver module, a Bluetooth transceiver module, an Ethernet port, a Universal
20 Serial Bus (USB) port, or any other module / component / device configured for transmitting and receiving data.

The remote server 410 may be based on a centralized model, decentralized model, or hybrid model. As used herein, a server is a physical or cloud data processing
25 system on which a server program runs. The server may be implemented in hardware or software, or a combination thereof. Some non-limiting examples of the server include computers, laptops, mini-computers, mainframe computers, any non-transient and tangible machines that can execute a machine-readable code, cloud-based servers, distributed server networks, and a network of computers.

30 A user electronic device 420 may be, but is not limited to, a mobile phone or tablet device. A mobile software application or app may be installed and executable on the user electronic device 420 for collecting the mail items. In some embodiments, the

user electronic device 420 is or includes an electronic access card or fob that is based on NFC or RFID technology. For example, the user electronic device 420 is a mobile phone that has an NFC or RFID module embedded therein. In some embodiments, an identification card and/or facial recognition can be used to collect the mail items. The mailbox assembly 100 may include a control device or user input device that is communicative with the control module and configured for communicating with the user electronic device 420 during collection of the mail items 210. For example, the user input device includes a human machine interface. The user input device may provide suitable prompts and/or notifications to guide the user in the collection process.

The user input device is configured to receive user input data from the user for collecting one or more mail items 210. The control module is configured to verify the user input data against user reference data. The user reference data includes reference input data for the user for verification against the user input data, as well as the user's mailing address.

In some embodiments, verifying the user input data includes receiving, by the control module, the user reference data from the remote server 410. For example, the remote server 410 may send to the mailbox assembly 100 the user reference data for all users of the mailbox assembly 100, i.e. the residents in the building where the mailbox assembly 100 is installed. The user input data can thus be verified against the reference input data locally using the control module.

In some embodiments, verifying the user input data includes sending, using the control module, the user input data to the remote server 410 for verification of the user input data. The control module then receives a verification message from the remote server 410 indicating that the user input data has been successfully verified.

In one example, the user input data includes a one-time password (OTP) requested by the user using the app on the user electronic device 420. The OTP may be sent from the remote server 410 to the user electronic device 420 via a messaging service such as SMS or via a notification on the app. The user input device may

include a touch panel, keyboard, and/or keypad, for the user to enter the OTP. The remote server 410 would be able to verify the OTP and determine that the user is the intended recipient of the mail items 210. Alternatively, the remote server 410 also sends the OTP to the mailbox assembly 100 to serve as the reference input data.

- 5 The control module would be able to locally verify the user input OTP against the reference input OTP.

In another example, the user input data is a one-time optical code, such as a data matrix code or QR code, requested using the app. The optical code is generated by the remote server 410 and displayed on the app. The user input device may include a scanner device for reading the optical code. Alternatively, the remote server 410 also sends the optical code to the mailbox assembly 100 to serve as the reference input data. The control module would be able to locally verify the user input optical code against the reference input optical code.

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The OTP / optical code may expire after a predefined expiry period, such as 2 minutes, after which the OTP / optical code becomes inactive and the user cannot use it to collect the mail items 210. The user may request for a fresh OTP / optical code.

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In another example, the user input data is an electronic signal, such as an NFC or RFID signal, sent from the user electronic device 420. The user input device may include a sensor for detecting the electronic signal. The electronic device 420 may be pre-registered with the remote server 410 to provide a specimen copy of the electronic signal for verification. Alternatively, the remote server 410 may send the specimen copy of the electronic signal to the mailbox assembly 100 to serve as the reference input data for local verification.

In another example, the user input data includes user identity data and/or facial recognition data. The user identity data may include a user identifier such as a national identifier from an identification card of the user, and the facial recognition data may be captured by the facial recognition camera. The user may be pre-registered with the remote server 410 to provide a specimen copy of the identity data

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and/or facial recognition data as the reference input data for verification by the remote server 410.

The user input data may further include details of the user's mailing address, such as the postal code and/or unit number. The user input data may further include contact details of the user, such as a mobile phone number and/or email address. The user may enter these additional details via the user input device. These additional details are recorded on the remote server 410 during the pre-registration and are thus verifiable by the remote server 410. These details may be included in the user reference data for local verification by the mailbox assembly 100. These details can be used to verify that the user is the intended recipient of the mail items 210 addressed to the user's mailing address.

The mailbox assembly 100 may include a set of camera devices 140, such as shown in Figures 1A and 1B. The camera devices 140 may include a facial recognition camera configured to gather facial information of the user collecting the mail items. This facial information can also be used for facial verifications of the user and also to resolve disputes in future. The camera devices 140 may be connected to a CCTV system that continuously monitors activity around the mailbox assembly 100. The CCTV system can serve as a deterrent against mishandling or tampering of the mailbox assembly 100, as well as against crimes like vandalism and theft.

In various embodiments of the present disclosure, with reference to Figure 8, there is a process 500 for automated release of mail items 210 in the mailbox assembly 100 for collection by the user. The process 500 includes various steps performed by the mailbox assembly 100, remote server 410, and user electronic device 420.

In a step 502, the mail carrier arrives at the mailbox assembly 100 and loads a batch of mail units 200 into the storage units 110. In a step 504, the scanning system scans the identifier labels of the mail units 200. In a step 506, the control module receives, from the remote server 410, the address data of each partition 220 of each mail unit 200 identified by its respective scanned identifier label. Alternatively, the remote server 410 sends the address data to the mailbox assembly 100 before the

mail carrier arrives at the mailbox assembly 100. In a step 508, the control module determines, from the address data, the mailing address associated with each partition 220, thereby mapping the mailing addresses of the mail items 210 in the partitions 220.

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In a step 510, after mapping the mailing addresses using the address data received from the remote server 410, the control module sends a confirmation message to the remote server 410. In a step 512, the remote server 410 sends a notification message to the user electronic device 420 to inform the user that he/she has new mail items 210 stored in the mailbox assembly 100. The notification message may be sent to the app on the user electronic device 420. Alternatively, or additionally, the notification message may be sent via a messaging service (e.g. SMS or app notification) and/or email to the user. The remote server 410 may obtain contact details of the users, such as phone number or email address, from a pre-registration process for users of the mailbox assembly 100.

After receiving the notification message which may be displayed on the app executed on the user electronic device 420, the user goes to the mailbox assembly 100 to collect the mail items. In one example, in a step 514, the user uses the app to send a request to the remote server 410 for an OTP or one-time optical code. In a step 516, the remote server 410 processes the request and generates the OTP. In a step 518, the remote server 410 sends the OTP to the user electronic device 420. In a step 520, the remote server 410 sends the OTP to the mailbox assembly 100 for local verification of the user input data by the mailbox assembly 100.

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In a step 522, the user provides user input data to the user input device of the mailbox assembly 100 to collect the mail items 210. In one example, the user input data includes the OTP and is entered by the user on the user input device. In another example, the user input device reads the optical code displayed on the user electronic device 420. Optionally, the user input device may prompt the user to enter additional details for verification, such as mail address details or contact details. In a step 524, the control module verifies the user input data against the user reference

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data. The user reference data includes the reference input data from the OTP received in the step 520.

5 In some embodiments, the user uses an NFC or RFID signal, such as from the user electronic device 420, to collect the mail items. The user input device receives the user input data containing the NFC or RFID signal and verifies it against the user reference data containing a specimen copy of the NFC or RFID signal as the reference input data. Alternatively, the mailbox assembly 100 may send the user input data to the remote server 410 for verification. The user input data may include
10 user identity data and/or facial recognition data. Upon verification of the user input data by the remote server 410, the remote server 410 returns a verification message to the control module.

In a step 526, the control module identifies one or more partitions 220 that are
15 associated with the user's mailing address in response to verification of the user input data. In a step 528, the control module controls movement of the collection unit 120 and actuation mechanism 130 to one or more storage units 110 containing the mail units 200 having the identified partitions 220. In a step 530, after the collection unit 120 and actuation mechanism 130 are positioned at each storage unit 110, the
20 control module controls the actuation mechanism 130 to displace the mail items 210 in the identified partitions 220 of the mail unit 200 in the respective storage unit 110 into the collection unit 120. Accordingly, the mail items 210 are released into the collection unit 120 for collection by the user. The collection unit 120 may move to the collection window 122 for the user to retrieve the mail items 210. In a step 532, the
25 control module may send a collection message to the remote server 410 to confirm that the mail items 210 have been collected.

In some embodiments, the scanning system scans the partition labels of the partitions 220 of each mail unit 200. The control module receives, from the remote
30 server 410, the size data of each partition 220 identified by its respective scanned partition label. The control module controls the actuation mechanism 130 to adjust the width of the actuator 134 based on the size data of the partitions 220. The partition sizes are recorded when the mail items 210 are being sorted into the

partitions 220 at the central postal location or mail distribution centre. For example, when the actuator 134 is positioned at a partition 220 to displace the mail items 210 contained in the partition 220 into the collection unit 120, the width of the actuator 134 is adjusted to fit the partition 220. This ensures that all the mail items 210 in the partition 220 are displaced into the collection unit 120. The size data may be sent from the remote server 410 together with the address data.

In some embodiments as shown in Figure 1E, one or more of the storage units 110, such as at the lower portion of the mailbox assembly 100, are larger in size and are designated to receive one or more mail items 210 such as large packages. Each of these storage units 110 may be loaded with a respective one of the larger mail items 210 or packages and each has an identifier label similar to that of the mail unit 200. Accordingly, a large mail item 210 or package stored in one of these storage units 110 may also be referred to as a mail unit 200. After the large mail items 210 are loaded into the storage units 110, the scanning system scans the identifier labels of the large mail items 210. The scanned identifier labels are matched against the address data received from the remote server 410 to determine the mailing address associated with each large mail item 210. A user inputs the user input data, and the control module identifies one or more storage units 110 holding one or more mail items 210 associated with the user's mailing address in response to verification of the user input data. The collection unit 120 and actuation mechanism 130 move to the identified storage units 110 holding the user's mail items 210. The actuation mechanism 130 then displaces the user's mail items 210 in the identified storage units 110 into the collection unit 120 for collection by the user.

As described in various embodiments herein, the system 400 and the process 500 provide several advantages in the processing of mail items that benefit postal companies and the public. The mail carrier would take less time to load a batch of mail units 200 to the mailbox assembly 100 as the mail carrier does not need to manually sort out the mail items 210 by the mailing addresses. The mail items 210 have already been sorted out into the partitions 220 at the central postal location or mail distribution centre. By reducing the time spent for a mailbox assembly 100, the mail carrier can deliver mail units 200 to other mailbox assemblies 100 in other

buildings and serve more buildings. This results in higher efficiency and savings in labour costs as less manpower is required. The tendency of mistakes made by the mail carrier is also reduced as there is no manual sorting of mail items 210 to be done.

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A mail unit 200 can be loaded with different sized mail items 210 in different partitions 220 addressed to different mail addresses. The partitions 220 can be sized differently to cater to different mail items 210 of various shapes and sizes. This improves efficiency of the utilisation of storage space in the mail units 200, thereby
10 optimising the volume of mail items 210 that can be loaded into the mailbox assembly 100.

Another advantage is the traceability of mail items 210 from delivery by the mail carrier to collection by the users. Electronic records are kept by the remote server
15 410 when new mail items 210 arrive at the mailbox assembly 100 and when mail items 210 are collected by the users. Postal companies can analyze the electronic records to monitor and trace the mail items 210, including ordinary mail, and obtain information such as whether the mail items 210 are delivered timely. Postal companies can also rely on these electronic records for future verification or auditing
20 purposes.

Another advantage is that when a user needs to provide an acknowledgement to confirm that the user has collected the mail items 210. Particularly, when the user provides the user input data (such as the OTP) to collect the mail items 210, this is
25 an acknowledgement that the mail items 210 have been collected by the user. Acknowledgements can thus be obtained for all types of mail items 210 other than registered mail, including ordinary mail which normally do not have such acknowledgements. Moreover, the system 400 and the process 500 can be implemented with digital signature functions for stronger authentication of the user's
30 identity, especially for important mail items 210 like legal letters and court summons.

In the foregoing detailed description, embodiments of the present disclosure in relation to a mailbox assembly for automated release of mail items are described

with reference to the provided figures. The description of the various embodiments herein is not intended to call out or be limited only to specific or particular representations of the present disclosure, but merely to illustrate non-limiting examples of the present disclosure. The present disclosure serves to address at
5 least one of the mentioned problems and issues associated with the prior art. Although only some embodiments of the present disclosure are disclosed herein, it will be apparent to a person having ordinary skill in the art in view of this disclosure that a variety of changes and/or modifications can be made to the disclosed embodiments without departing from the scope of the present disclosure. Therefore,
10 the scope of the disclosure as well as the scope of the following claims is not limited to embodiments described herein.

Claims

1. A mailbox assembly for automated release of mail items, the mailbox assembly comprising:

5 a plurality of storage units for receiving a plurality of mail units, each mail unit comprising an identifier label and a plurality of partitions, each partition comprising one or more mail items addressed to a mailing address associated with the respective partition;

10 a collection unit configured to move to each storage unit to receive the mail items from the respective storage unit;

an actuation mechanism configured to move to each storage unit to displace the mail items in one or more partitions of the respective mail unit into the collection unit;

15 a scanning system for scanning the identifier labels of the mail units in the storage units; and

a control module configured for:

receiving address data of each partition of each mail unit, the address data comprising the mailing addresses associated with the partitions;

20 matching the scanned identifier labels against the address data to determine the mailing address associated with each partition of each mail unit in the storage units;

25 identifying one or more partitions associated with the mailing address of a user collecting the mail items addressed to the user's mailing address; and

controlling movement of the collection unit and actuation mechanism to displace the mail items in the identified partitions into the collection unit for collection by the user.

30 2. The mailbox assembly according to claim 1, further comprising the mail units, wherein each mail unit is loaded in the one of the storage units.

3. The mailbox assembly according to claim 1 or 2, wherein the identifier label of each mail unit comprises machine-readable optical code.
4. The mailbox assembly according to any one of claims 1 to 3, wherein each
5 partition of a mail unit comprises a partition label.
5. The mailbox assembly according to claim 4, wherein the partition label comprises machine-readable optical code.
- 10 6. The mailbox assembly according to any one of claims 1 to 5, further comprising a collection window, wherein the collection unit is configured to move to the collection window for the user to retrieve the mail items.
7. The mailbox assembly according to any one of claims 1 to 6, wherein the
15 actuation mechanism comprises an actuator that is adjustable to fit the partitions, thereby facilitating displacement of mail items in the partitions into the collection unit.
8. The mailbox assembly according to any one of claims 1 to 7, wherein the
20 scanning system comprises a set of imaging devices moveable within the mailbox assembly.
9. The mailbox assembly according to any one of claims 1 to 8, wherein the
25 scanning system comprises a plurality of imaging devices, each storage unit comprising one of the imaging devices.
10. The mailbox assembly according to any one of claims 1 to 9, further comprising a user input device communicative with the control module and configured for receiving user input data from the user.
- 30 11. The mailbox assembly according to any one of claims 1 to 10, wherein:
a set of storage units is arranged for receiving a set of mail items, each mail item comprising an identifier label and addressed to a mailing address;

the scanning system is configured for scanning the identifier labels of the mail items in the storage units; and

the control module is configured for:

receiving address data of each mail item, the address data comprising the mailing addresses associated with the mail items;

matching the scanned identifier labels against the address data to determine the mailing address associated with each mail item in the storage units;

identifying one or more storage units holding one or more mail items associated with the mailing address of a user;

moving a collection unit and an actuation mechanism to the identified storage units holding the user's mail items; and

displacing, using the actuation mechanism, the user's mail items in the identified storage units into the collection unit for collection by the user.

12. A method for automated release of mail items, the method comprising:

receiving a plurality of mail units in a plurality of storage units, each mail unit comprising an identifier label and a plurality of partitions, each partition comprising one or more mail items addressed to a mailing address associated with the respective partition;

scanning the identifier labels of the mail units in the storage units;

receiving address data of each partition of each mail unit, the address data comprising the mailing addresses associated with the partitions;

matching the scanned identifier labels against the address data to determine the mailing address associated with each partition of each mail unit in the storage units;

identifying one or more partitions associated with the mailing address of a user collecting the mail items addressed to the user's mailing address;

moving a collection unit and an actuation mechanism to a storage unit comprising the identified partitions; and

displacing, using the actuation mechanism, the mail items in the identified partitions into the collection unit for collection by the user.

13. The method according to claim 12, further comprising moving the collection unit to a collection window for the user to retrieve the mail items.

5 14. The method according to claim 12 or 13 wherein the identified partitions are in two or more mail units, the method comprising:

moving the collection unit and the actuation mechanism to a first storage unit comprising a first mail unit of the two or more mail units;

10 displacing, using the actuation mechanism, the mail items in the identified partitions in the first mail unit into the collection unit;

moving the collection unit and the actuation mechanism to a second storage unit comprising a second mail unit of the two or more mail units; and

15 displacing, using the actuation mechanism, the mail items in the identified partitions in the second mail unit into the collection unit.

15 15. The method according to any one of claims 12 to 14, further comprising moving a plurality of imaging devices to scan the identifier labels of the mail units in the storage units.

20 16. The method according to any one of claims 12 to 15, further comprising adjusting the actuation mechanism to fit the partitions, thereby facilitating displacement of mail items in the partitions into the collection unit.

25 17. The method according to claim 16, wherein each partition of a mail unit comprises a partition label, the method further comprising:

scanning the partition label of a partition of the mail unit;

receiving size data of the partition; and

30 adjusting the actuation mechanism based on the size data of the partition to fit the partition.

18. The method according to any one of claims 12 to 17, further comprising:
receiving user input data from the user for collecting one or more mail items;

verifying the user input data against the user reference data; and
identifying the partitions that are associated with the user's mailing
address in response to verification of the user input data.

- 5 19. The method according to any one of claims 12 to 18, further comprising:
- receiving a set of mail items in a set of storage units, each mail item
 comprising an identifier label and addressed to a mailing address;
- scanning the identifier labels of the mail items in the storage units;
- receiving address data of each mail item, the address data comprising
10 the mailing addresses associated with the mail items;
- matching the scanned identifier labels against the address data to
 determine the mailing address associated with each mail item in the storage
 units;
- identifying one or more storage units holding one or more mail items
15 associated with the mailing address of a user;
- moving a collection unit and an actuation mechanism to the identified
 storage units holding the user's mail items; and
- displacing, using the actuation mechanism, the user's mail items in the
 identified storage units into the collection unit for collection by the user.

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