

MAILBOX ASSEMBLY FOR AUTOMATED SORTING OF MAIL ITEMS

Technical Field

- 5 The present disclosure generally relates to a mailbox assembly for automated sorting of mail items.

Background

- 10 Currently, postal companies handle various types of mail items, including ordinary mail, registered mail, packets and parcels, received through both local and international postal agencies and deliver these mail items to recipients. 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
15 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 these mail deliveries.

- One problem with current mailboxes is the lack of traceability of ordinary mail to
20 ensure they are delivered to the recipients. Postal companies cannot monitor delivery of all mail items (including ordinary mail) to the recipients. Postal companies also cannot obtain reliable data that shows the mail items are delivered to the recipients on time or within stipulated time frames according to service level agreements.

25

- Another problem is the time taken by a mail carrier (e.g. postman) sort and deposit the mail items to the respective mailboxes according to the mailing addresses. For example, for a high-rise building with an average of 100 residential units, the mail carrier needs to spend an average of 20 minutes for mail sorting and depositing into
30 the mailboxes. It is unpredictable how long it would take for the mail carrier to sort and deposit all the mail items, especially 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 mail carrier could make mistakes and deposit some mail items to the wrong mailboxes.

As the mail carrier needs to manually deposit mail items to the mailboxes, the mailboxes must be installed at ergonomic heights for the mail carrier to access. This limits the overall height and capacity of the mailboxes. This is an inefficient use of the floor area occupied by the mailboxes as the space above the mailboxes are unutilized.

Additionally, while postal companies, like courier companies, often require acknowledgements from the recipients after delivering certain types of mail items like registered mail and large parcels, postal companies do not get acknowledgements from the recipients collecting their mail items from these mailboxes. It would be a significant cost for postal 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.

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 sorting of mail items, the mailbox assembly comprising:

- a number of loading units for loading a batch of mail items, each mail item comprising an address label representing a mailing address;

- a plurality of storage units for storing the mail items for subsequent collection;

- a carriage assembly for transferring the mail items from the loading units to the storage units;

- an imaging device for scanning the address labels on the mail items; and

- a control module configured for:

receiving mail reference data associated with the address labels of the batch of mail items;

matching the scanned address labels against the mail reference data; and

5 allocating a respective storage unit to each mail item based on the matched address label,

wherein the carriage assembly is configured for transferring each mail item to the respective allocated storage unit.

10 According to a second aspect of the present disclosure, there is a method for automated sorting of mail items in a mailbox assembly, the method comprising:

receiving the mail items in number of loading units of the mailbox assembly, each mail item comprising an address label representing a mailing address;

15 receiving mail reference data associated with the address labels of the mail items; and

for each mail item:

scanning the address label on the mail item using an imaging device of the mailbox assembly;

20 matching, using a control module of the mailbox assembly, the scanned address label against the mail reference data;

allocating, using the control module, a respective one of a plurality of storage units of the of the mailbox assembly to the mail item based on the matched address label; and

25 transferring, using a carriage assembly of the of the mailbox assembly, the mail item from the loading units to the respective allocated storage unit.

According to a third aspect of the present disclosure, there is a method for automated releasing of sorted mail items in a mailbox assembly for collection by a user, the method comprising:

30 receiving, by a control device of the mailbox assembly, user input data from the user for collecting one or more mail items stored in one or more storage units of the mailbox assembly;

verifying, using a control module of the mailbox assembly, the user input data against the user reference data comprising one or more identifiers of the one or more storage units; and

5 opening, using the control module, the one or more storage units based on the identifiers in the verification message, thereby releasing the one or more mail items stored therein for collection by the user.

10 A mailbox assembly for automated sorting 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.

Brief Description of the Drawings

15

Figure 1 is an illustration of the exterior of a mailbox assembly according to embodiments of the present disclosure.

Figure 2A to Figure 2D are illustrations of the interior of the mailbox assembly.

20

Figure 3A to Figure 3D are illustrations of a carriage assembly of the mailbox assembly.

25 Figure 4 is a flowchart illustration of a method for automated sorting of mail items in the mailbox assembly, according to embodiments of the present disclosure.

Figure 5A and Figure 5B are illustrations of a loading unit of the mailbox assembly.

30 Figure 6A to Figure 6F are illustrations of a transfer tray assembly of the mailbox assembly.

Figure 7A to Figure 7D are illustrations of a storage unit assembly of the mailbox assembly.

Figure 8 is an illustration of various configurations of the storage unit assembly.

Figure 9 is another illustration of the interior of the mailbox assembly.

5

Figure 10 is a schematic illustration of a system comprising the mailbox assembly for processing mail items, according to embodiments of the present disclosure.

10

Figure 11 is a flowchart illustration of a method for automated releasing of sorted mail items in the mailbox assembly for collection by a user, according to embodiments of the present disclosure.

15

Figure 12 is a schematic illustration of a process for automated sorting and releasing of mail items in the mailbox assembly, according to embodiments of the present disclosure.

Detailed Description

20

For purposes of brevity and clarity, descriptions of embodiments of the present disclosure are directed to a mailbox assembly for automated sorting 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 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 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, and components have not

25

30

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 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 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 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. 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 can correspond to a unit, singlet, or single-element set, or a multiple-element set), in accordance with known mathematical definitions.

In representative or exemplary embodiments of the present disclosure, with reference to Figure 1, there is a mailbox assembly 100 for automated sorting 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, magazines, publications, postcards, greeting cards, and the like. These mail items are 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.

Further with reference to Figure 2A to Figure 2D, the mailbox assembly 100 includes a number of one or more loading units 120 for loading a batch or a bulk of mail items. More specifically, when the mail carrier arrives at the mailbox assembly 100, the mail carrier delivers a batch of one or more mail items and loads the mail items into the loading units 120. Each mail item has an address label representing a mailing address. For example, as will be described further below, the address label may include a machine-readable optical code, such as a 2D code (e.g. QR code or data matrix code) or 1D barcode, etc., that is encoded or associated with the mailing address. For example, the Data matrix code is encoded with the mailing address or an identifier associated with the mailing address.

The mailbox assembly 100 further includes a plurality of storage units 140 for storing the mail items for subsequent collection. The storage units 140 may be arranged in one or more storage unit assemblies 160, each storage unit assembly 160 having a number of storage units 140 that are stacked vertically. The mailbox assembly 100 further includes a carriage assembly 200 for transferring the mail items from the loading units 120 to the storage units 140. More specifically, after the mail items have been loaded in the loading units 120, the carriage assembly 200 picks the mail items and moves them to the storage units 140. Users or recipients can subsequently collect the mail items from the storage units 140. In some embodiments, the mailbox assembly 100 includes one or more collection units 180 such that during collection, the storage units 140 release the mail items to the collection units 180 where the mail items can be collected by the users.

The mailbox assembly 100 further includes an imaging device 220 for scanning the address labels on the mail items. The imaging device 220 may include a camera or image capture device capable of capturing images and/or videos, as well as reading machine-readable optical code.

5

In some embodiments, the imaging device 220 is stationary and positioned above the loading units 120 for scanning the address labels on the mail items loaded in the loading units 120. The mailbox assembly 100 may include a number of imaging devices 220 corresponding to the number of loading units 120, such that each
10 imaging device 220 is positioned above the respective loading unit 120. In some embodiments, the imaging device 220 is moveable within the mailbox assembly 100 for scanning the mail items loaded in different loading units 120. The imaging device 220 may be moveable independently of the carriage assembly 200 that transfers the mail items. Preferably, in some embodiments as shown in Figure 3A and Figure 3B,
15 the imaging device 220 is part of the carriage assembly 200 and is moveable together with the carriage assembly 200.

The mailbox assembly 100 further includes a control module configured for receiving mail reference data associated with the address labels of the batch of mail items and
20 for matching the scanned address labels against the mail reference data. The mail reference data is stored on a data storage module of the mailbox assembly 100, such as a hard disk drive or memory module. The mail reference data may be sent by a remote server, such as the central postal location or mail distribution centre. For example, the remote server sends the mail reference data to the mailbox assembly
25 100 before the mail carrier arrives at the mailbox assembly 100 to deliver the batch of mail items. Alternatively, the mail carrier may load the mail reference data into the data storage module, such as through a portable data storage device preloaded with the mail reference data.

30 As an example, the address label of a mail item includes a QR code that can be scanned and decoded by the imaging device 220. The decoded QR code is then matched against the mail reference data to determine whether the mail item is correctly delivered to the mailbox assembly 100. If the address label cannot be

matched to an appropriate data entry in the mail reference data, this could mean that the mail item was delivered to the wrong mailbox assembly 100.

5 The control module is further configured for allocating a respective storage unit 140 to each mail item based on the matched address label. The carriage assembly 200 is configured for transferring each mail item to the respective allocated storage unit 140, such as by using robotic actuators. Therefore, the mailbox assembly 100 is able to automatically sort the mail items according to their matched address labels and move the mail items, using the carriage assembly 200, to their respective allocated
10 storage units 140.

In various embodiments of the present disclosure, with reference to Figure 4, there is a method 300 for automated sorting of mail items in the mailbox assembly 100. The method 300 includes a step 302 of receiving the mail items in the loading units 120,
15 each mail item having the address label representing the mailing address. The method 300 includes a step 304 of receiving mail reference data associated with the address labels of the mail items.

The method 300 includes a step 306 of, for each mail item, scanning the address
20 label on the mail item using the imaging device 220. The method 300 includes a step 308 of, for each mail item, matching, using the control module, the scanned address label against the mail reference data. The method 300 includes a step 310 of, for each mail item, allocating, using the control module, a respective one of the storage units 140 to the mail item based on the matched address label. The method 300
25 includes a step 312 of, for each mail item, transferring, using the carriage assembly 200 including the robotic actuators thereof, the mail item from the loading units 120 to the respective allocated storage unit 140.

Notably, the steps 306, 308, 310, and 312 of the method 300 are for each mail item.
30 More specifically, the steps constitute an iterative process wherein the next mail item is scanned and moved from the loading units 120 to the storage units 140 after the current mail item has been stored in the storage units 140. The iterative process

continues until all the mail items in the loading units 120 have been sorted and stored in the storage units 140.

5 In some embodiments, each storage unit 140 is pre-assigned to a respective mailing address corresponding to a unit (e.g. residential or commercial unit) in the building where the mailbox assembly 100 is installed. Mail items that are sent to a particular mailing address at different times would be sorted and stored in the same storage unit 140. In some embodiments, the control module allocates an available storage unit 140 to the current mail item. Mail items that are sent to a particular mailing
10 address at different times may be sorted and stored in different storage units 140. Additionally, mail items may be sorted and stored in different storage units 140 depending on their sizes and/or availability of remaining or vacant storage units 140 suitable for their sizes. For example, one or more storage units 140 may be sized to be suitable for large parcels, while one or more other storage units 140 may be sized
15 to be suitable for ordinary letters.

Similarly, the loading units 120 may be in various sizes to cater for different mail items. For example, some loading units 120 are sized for letters in C4 to C6 and DL envelope sizes. Other loading units 120 may be sized for larger parcels or packages.
20 When the mail carrier arrives at the mailbox assembly 100, the mail carrier loads a batch of mail items to the loading units 120 according to their sizes.

With reference to Figure 5A and Figure 5B, each loading unit 120 includes a linear actuation mechanism 122 coupled to a loading plate 124. Mail items are loaded onto
25 the loading plate 124 and the linear actuation mechanism 122 is configured to move the loading plate 124 vertically upwards and downwards to facilitate transfer of the mail items. The loading plate 124 may include a brush along its perimeter to prevent the mail items from getting stuck during the vertical actuation.

30 The loading unit 120 further includes air curtains 126 that allow air to pass through. More specifically, the loading unit 120 includes a pneumatic source that generates airflow towards the air curtains 126 and the loading plate 124. The airflow assists in separating mail items from each other, especially the mail item at the top end of the

loading unit 120 from other mail items, to mitigate risk of double picking by the carrier assembly 200.

The loading unit 120 further includes an object sensor 128 disposed at the top end.

5 The object sensor 128 is configured to detect presence of a mail item at the top end. Notably, the mail item at the top end is the next mail item (e.g. first mail item) to be transferred by the carriage assembly 200. The object sensor 128 cooperates with the linear actuation mechanism 122 to move the following mail item (e.g. second mail item that is below the first mail item) upwards after the first mail item has been
10 picked up.

As shown in Figure 3A and Figure 3B, the carriage assembly 200 includes the imaging device 220 and at least one picking mechanism 240 for picking the mail items. The picking mechanism 240 includes a picking member 242 and a vertical
15 actuator 244 coupled to each other. The vertical actuator 244 is configured to move the picking member 242 upwards and downwards to physically contact each mail item and pick up the mail item. The picking member 242 may operate by vacuum suction, although it will be appreciated that other picking mechanisms can be used, such as robotic grippers.

20 In some embodiments as shown in Figure 3C and Figure 3D, the picking member 242 is coupled at an angle to the vertical actuator 244. This angle may be up to 20°, and preferably ranges from 2° to 15°. This angled arrangement of the picking member 242 and vertical actuator 244 enables the picking member 242 to pick up
25 the first mail item at an angle relative to the second mail item below the first mail item. This consequently forms a gap between the first and second mail items and allows airflow to pass through the gap. This airflow assists in separating the first mail item from the second mail item, thereby mitigating risk of double picking both the first and second mail items. The picking member 242 may be pivotally coupled to the vertical
30 actuator 244. This allows some pivotal motion of the picking member 242 when it is moved downwards to pick up the next mail item, especially if the next mail item does not have a horizontally flat surface.

In some embodiments, the carriage assembly 200 includes a plurality of picking mechanisms 240. One picking mechanism 240 may be used for picking smaller mail items such as ordinary letters. Two or more picking mechanisms 240 may be used for picking larger mail items, such as large parcels, to stabilize the transfer of these mail items to the storage units 140.

The carriage assembly 200 includes a set of carriage actuation mechanisms for moving the at least one picking mechanism 240, vertically and horizontally to thereby transfer the mail items from the loading units 120 to various storage units 140. The carriage actuation mechanisms may include robotic actuators such as gantry robots having linear actuators configured for xyz linear movements. For example, the carriage actuation mechanisms include a set of telescopic members 202 and a rack and pinion mechanism 204. The carriage actuation mechanisms may further include a limit sensor 206 that controls the actuation range or stroke of the telescopic members 202 and rack and pinion mechanism 204. The carriage actuation mechanisms may further include a physical stopper for physically stopping the actuation at the maximum stroke. In some embodiments, the imaging device 220 is part of the carriage assembly 200 and is moveable together with the picking mechanism 240.

The carriage assembly 200 includes a height sensor 208 for measuring the vertical distance between the height sensor 208 and the mail item directly below the height sensor 208. The measured vertical distance can be used to estimate the height or thickness of the mail item and determine the suitable storage unit 140 for the mail item. The height sensor 208 may be a non-contact sensor that uses a laser for the height measurement.

In some embodiments as shown in Figure 6A, the carriage assembly 200 includes a transfer tray assembly 260 for holding the mail items during transfer from the loading units 120 to the storage units 140. More specifically, the transfer tray assembly 260 includes a tray member 262 and the picking member 242 is configured to pick up a mail item and place it on the tray member 262. The transfer tray assembly 260 is moveable, by the carriage actuation mechanisms, to the allocated storage unit 140

and the transfer tray assembly 260 is configured to transfer the mail item from the tray member 262 to the allocated storage unit 140.

5 The transfer tray assembly 260 includes a tray actuation mechanism for moving the tray member 262. For example as shown in Figure 6B, the tray actuation mechanism includes a set of telescopic members 264 and a rack and pinion mechanism 266. The tray actuation mechanism further includes a motorized mechanism 268 for actuating the rack and pinion mechanism 266. The motorized mechanism 268 may include a set of pulleys and a timing belt for controlling the gear ratio and the torque
10 required to actuate the rack and pinion mechanism 266. The tray actuation mechanism may further include a limit sensor 270 that controls the actuation range or stroke of the telescopic members 264 and rack and pinion mechanism 266. The tray actuation mechanism may further include a physical stopper 272 for physically stopping the actuation at the maximum stroke. Further as shown in Figure 6C, the
15 tray actuation mechanism includes a tilting mechanism 274 for tilting the tray member 262. The tilting mechanism 274 cooperates with the rack and pinion mechanism 266 to linearly actuate or slide the tray member 262 and to tilt it downwards to facilitate dropping of the mail item into the allocated storage unit 140. The tilting mechanism 274 may be configured to tilt the tray member 262 at a tilting
20 angle of up to 50°. Preferably, the tilting angle ranges from 40° to 50° to drop the mail item.

In some embodiments as shown in Figure 6D, the transfer tray assembly 260 includes a collision detection mechanism 276 configured to prevent a hard collision
25 with the storage units 140 during actuation / tilting of the tray member 262. The collision detection mechanism 276 includes a front bumper 278, a set of connecting members 280 (e.g. linear shafts), a set of compression springs 282, and a set of compression sensors 284. The front bumper 278 is disposed underneath the tray member 262 and is preferably made of a soft or resilient material, such as rubber,
30 silicone, or a suitable plastic material. The front bumper 278 is connected to the compression springs 282 and compression sensors 284 via the connecting members 280. When the front bumper 278 physically contacts an obstruction such as the storage units 140, the compression sensors 284 detect the obstruction and sends a

signal to the tray actuation mechanism to stop further actuation of the tray member 262. The front bumper 278 thus prevents a hard collision by arresting the actuation quickly in response to any physical contact. Additionally, the compression springs 282 are compressed when the front bumper 278 physically contacts the obstruction and return to the neutral state after the front bumper 278 clears the obstruction, such as when the tray member 262 is actuated back to the original position.

In some embodiments as shown in Figure 6E, the transfer tray assembly 260 includes a clamping mechanism 286 for clamping the mail item and holding the mail item on the tray member 262. The clamping mechanism 286 includes a clamping member 288 and a biasing member 290 configured to engage with the mail item. The biasing member 290, which may include a spring element, provides some flexible adjustment to different sizes of the mail item. The clamping mechanism 286 further includes a micro or miniature stepper motor 292 for rotating the clamping member 288 between the original position and the clamping position where the biasing member 290 engages with the mail item. The clamping mechanism 286 may include a proximity sensor 294 for determining the original position, such as the clamping member 288 being upright or perpendicular to the tray member 262.

In some embodiments as shown in Figure 6F, the transfer tray assembly 260 includes a set of mail stopper mechanisms 296 for preventing any mail item from returning to the tray member 262 when the tray member 262 is actuated back to the original position. Each mail stopper mechanism 296 includes a rotary member 298 that is rotatable from 0° to 90° relative to the tray member 262. After the tray member 262 is fully actuated to drop the mail item into the storage unit 140, the rotary member 298 is rotated to around 90° (upright as shown in Figure 6F (left drawing)) relative to the tray member 262, thus stopping the mail item.. The rotary member 298 in the upright position at 90° upright relative to the tray member 262, prevents the mail item from following the tray member 262 during its return actuation back to its original position. After the tray member 262 has fully returned to its original position, the rotary member 298 will rotate back to its original position at 0° relative to the trap member 262 (as shown in Figure 6F (right drawing)).

An exemplary transfer of a mail item from a loading unit 120 to a storage unit 140 is described as follows. More specifically, the loading unit 120 has a first mail item at the top end of the loading unit 120 and a second mail item below the first mail item. The loading unit 120 includes the object sensor 128 that detects presence of the first
5 mail item at the top end.

The carriage assembly 200 is pre-calibrated with the vertical position of the top end of the loading unit 120. The carriage actuation mechanisms move the picking mechanism 240 to the loading unit 120 for picking the first mail item. When the
10 picking member 242 is directly above the loading unit 120, the picking member 242 is moved downwards to physically contact the first mail item. Once the picking member 242 physically contacts the top surface of the first mail item, the downward movement stops and the picking member 242 begins to move upwards, holding the first mail item along with it. The picking member 242 may hold the first mail item by
15 vacuum suction.

The picking mechanism 240 is configured to measure the upward distance once the picking member 242 begins moving upwards. As the picking member 242 continues to move upwards, the first mail item also moves upwards away from the top end of
20 the loading unit 120. When the bottom surface of the first mail item clears the top end, the object sensor 128 does not detect the presence of the first mail item and signals the picking mechanism 240 to stop the measurement of the upward distance. The measured upward distance is equivalent to an estimated height or thickness of the first mail item which needs to clear the loading unit 120 before making any
25 horizontal movement to avoid hitting the first mail item such as by the transfer tray assembly 260. The picking member 242 continues to move upwards until the picking member 242 retracts fully.

The carriage actuation mechanisms then move the picking mechanism 240 and the
30 first mail item to the transfer tray assembly 260 for holding the first mail item. In one embodiment, the carriage assembly 200 is pre-calibrated with the vertical position of the tray member 262. The picking member 242 is moved downwards to the tray member 262 based on the estimated height of the first mail item and the pre-

calibrated vertical position of the tray member 262 to safely place the first mail item on the tray member 262. In another embodiment, the height sensor 208 measures the vertical distance to the tray member 262. The picking member 242 is moved downwards to the tray member 262 based on the estimated height of the first mail item and the measured vertical distance to the tray member 262.

After the picking member 242 has moved downwards, the picking member 242 places the first mail item on the tray member 262, such as by releasing the vacuum suction. The height sensor 208 then measures the vertical distance between the height sensor 208 and the top surface of the first mail item placed on the tray member 262. The difference between the vertical distances measured relative to the first mail item and to the tray member 262 is equivalent to an estimated height or thickness of the first mail item. The measurement by the height sensor 208 may be more precise and thus suitable for estimating the thickness of thin mail items like ordinary letters.

The imaging device 220 may scan the address label on the first mail item after the first mail item has been placed on the tray member 262. The control module then matches the scanned address label of the first mail item against the mail reference data and allocates a storage unit 140 to the first mail item based on the matched address label. Additionally, the control module may allocate an available storage unit 140 based on the estimated height or thickness of the first mail item.

The carriage actuation mechanisms then move the transfer tray assembly 260 to the allocated storage unit 140 to store the first mail item. When the transfer tray assembly 260 reaches the allocated storage unit 140, the tray actuation mechanism moves the tray member 262 to deposit the first mail item. More specifically, the tray actuation mechanism extends the tray member 262 forward and tilts the tray member 262 at an appropriate angle, such as from 40° to 50°, to drop the first mail item into the allocated storage unit 140. The vertical position of the tray member 262 before it starts to tilt is determined by the height of the mail items.

While the first mail item is being transferred to the allocated storage unit 140, the linear actuation mechanism 122 of the loading unit 120 is configured to move the second mail item upwards after the first mail item has cleared the loading unit 120. When the second mail item reaches the top end of the loading unit 120, the object
5 sensor 128 detects the second mail item and signals the linear actuation mechanism 122 to stop moving. The control module then sends a signal to the carriage assembly 200 to pick up the second mail item after the first mail item has been transferred to the allocated storage unit 140.

10 This iterative process of sorting mail items to the respective allocated storage units 140 continues until all the mail items in the loading unit 120 have been cleared. After clearing the mail items in the loading unit 120, the carriage assembly 200 begins to transfer the mail items in the next loading unit 120. The object sensors 128 of
15 respective loading units 120 detect whether there are mail items in the respective loading units 120 to be sorted, and corresponding send signals to the carriage assembly 200 to transfer the mail items to the respective allocated storage units 140.

The loading units 120 may include one or more holding units for temporarily holding mail items that cannot be sorted to a suitable storage unit 140. The holding units
20 may include an overload holding unit for holding mail items that cannot be sorted and stored in the storage units 140 because there are no available storage units 140. For example, all the storage units 140 already have mail items stored therein and/or a maximum number of storage units 140 for a particular household has already been taken up. When a storage unit 140 becomes available after collection, the control
25 module signals the carriage assembly 200 to transfer the mail items in the overload holding unit. Preferably, the control module is configured to prioritize transferring the mail items in the overload holding unit over the normal loading units 120. The holding units may include another type such as a rejection unit for holding mail items that are
30 rejected because the address label cannot be matched against the mail reference data. For example, the address label represents a mailing address that does not exist in the building where the mailbox assembly 100 is installed. For example, the address label may not be sufficiently clear, or may even be absent, for the imaging device 220 to scan and decode. The holding units may include a return mailbox unit

availed to users (e.g. residents in the building) so that the users can return mail items that do not belong to them. For example, addressees who previously resided in the building may have already moved out to different locations but their mail items are still being delivered to that mailbox assembly 100.

5

With reference to Figure 7A to Figure 7C, a storage unit assembly 160 includes a vertical stack of storage units 140 and a pair of vertical structural plates 162. The storage units 140 are mounted to the vertical structural plates 162 on both sides. The storage unit assembly 160 further includes a structural linkage 164 connected
10 between the vertical structural plates 162. The structural linkage member 164 may be configured to be slidable such that the storage unit assembly 160 can be slid out from the mailbox assembly 100, such as for maintenance or manual handling of the mail items stored in the storage units 140. The storage unit assembly 160 may include a control panel 166 disposed at the bottom for housing a set of electrical
15 components communicative with the control module for operating the storage unit assembly 160.

Each storage unit 140 includes a base member 142 that is disposed at an angle as shown in Figure 7C. Preferably, this angle ranges from 40° to 50°. The angled base
20 member 142 facilitates receipt of mail items from the carrier assembly 200 and also releasing of the mail items, such as to drop the mail items to the collection units 160. The storage unit 140 further includes a door 144 mounted to the vertical structural plates 162, as well as a door actuator 146 for opening and closing the door 144, such as shown in Figure 7C and Figure 7D. The storage unit 140 may include a limit
25 sensor 148 for detecting closure of the door 144 and to send a signal to the control panel 166. This signal verifies that the door 144 is properly closed and prevents mail items from being transferred to the storage unit 140 if the door 144 is not properly closed.

30 Some storage units 140 are sized to be suitable for large parcels and may receive heavy parcels. When a heavy parcel is dropped into the storage unit 140, there will be a pushing impact on the door 144 which may damage the door 144 and/or door actuator 146. Each storage unit 140 may include a magnetic lock 150 disposed on

both sides of the storage unit 140. The magnetic lock 150 includes a permanent electromagnet that has a permanent magnetic field to magnetically lock the door 144 when the door 144 is closed. This magnetic locking secures the door 144 and mitigates damage to the door 144 and/or door actuator 146 upon impact from heavy parcels. When the control panel 166 sends a signal to open the door 144, the magnetic lock 150 is supplied with an electric current to energize the permanent electromagnet. This neutralizes the magnetic field and unlocks the magnetic lock 150, thereby enabling the door actuator 146 to open the door 144.

The door 144 is opened when the door actuator 146 is forward extended fully. The door actuator 146 may be configured to remain in the forward extended state for a predefined period. In other words, the door 144 can remain open for the predefined period for collection of the mail items in the storage unit 140. After the predefined period, the door actuator 146 automatically retracts backwards to close the door 144. For some storage units 140, when the door 144 is closed, the magnetic lock 150 engages with and automatically locks the door 144.

Optionally, each storage unit 140 may include a lighting element 152 mounted to the vertical structural plates 162. The lighting element 152 may be configured to provide lighting signals or visual alerts associated with storing of mail items in the storage unit 140. The lighting elements 152 can also be used to guide the mail carrier if he/she wished to manually sort the mail items into the storage units 140, such as if the shape of the mail item is not suitable to pick by the picking member 242 or if there is a malfunction in the mailbox assembly 100. For example, the top surface of the mail item may be irregularly shaped such that the mail item cannot be readily picked up by the picking member 242.

The storage unit assembly 160 can be configured with various configurations and arrangements of the storage units 140. For example, a storage unit assembly 160 may have all the storage units 140 of the same size that is different from that of another storage unit assembly 160. A storage unit assembly 160 may have the storage units 140 in various sizes to cater for different sized mail items. Various exemplary configurations of the storage unit assembly 160 are illustrated in Figure 8.

In some embodiments, users or recipients can collect the mail items directly from the storage units 140. In some embodiments as shown in Figure 9, one or more storage unit assemblies 160 are configured to release the mail items from the storage units 140 to a collection unit 180. For example, 3 or 4 storage unit assemblies 160 may be grouped to one common collection unit 180 for more targeted releasing of the mail items. When the door 144 of a storage unit 140 is opened, the mail items in the storage unit 140 are released and dropped through a collection chute 182 to the collection unit 180. The angled base member 142 facilitates dropping of the mail items by gravity into the collection chute 182.

The collection unit 180 and/or collection chute 182 may include acoustic coatings for soundproofing. This reduces the noise generated by the mailbox assembly 100, especially when heavy mail items are dropped, and minimizes noise pollution to building units that are located near the mailbox assembly 100. The collection chute 182 may have a curved profile near the bottom so that dropped mail items can be diverted gently to the collection unit 180. The collection unit 180 may include a lighting element configured to provide lighting signals or visual alerts to users for collecting the mail items. For example, the lighting element is controlled by the respective control panel 166 to notify the user of which collection unit 180 to collect the mail items, especially if there are several mail items to be collected from a few collection units 180.

In various embodiments of the present disclosure, with reference to Figure 10, there is a system 400 for processing the mail items. The system 400 includes a set of one or more mailbox assemblies 100 and a remote server 420 communicative with the mailbox assemblies 100. The remote server 420 may be operated by a postal company that processes mail items and delivers them to the mailbox assemblies 100. The system 400 further includes a set of one or more electronic devices 440 that are used by users or recipients to collect the mail items from the mailbox assemblies 100. The system 400 further includes a communication network 460 for communication among the mailbox assemblies 100, remote server 420, and user electronic devices 440.

The communication network 460 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 460 for secure communications among the components. Some non-limiting examples of the communication network 460 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, fiber optic network, coaxial cable network, infrared (IR) network, radio frequency (RF) network, and any combination thereof. Various components in the communication network 460 may connect to the communication network 460 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 component to the communication network 460 includes a data communication or transceiver module to communicate and transmit / receive data over the communication network 460. 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 Serial Bus (USB) port, or any other module / component / device configured for transmitting and receiving data.

The remote server 420 may be based on a centralized model, decentralized model, or hybrid model. As used herein, a server is a physical or cloud data processing 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.

The electronic device 440 used by a user 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 440 for collecting the mail items. In some embodiments, the user electronic device 440 is or includes an electronic access card or fob that is based on NFC or RFID technology. For example, the user electronic device 440 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 110 communicative with the control module and configured for communicating with the user electronic device 440 during collection of the mail items. The control device 110 may provide suitable prompts and/or notifications to guide the user in the collection process.

The mailbox assembly 100 may optionally include a set of camera devices. The camera devices 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 future facial verifications of the user and also to resolve disputes in future. The camera devices 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 11, there is a method 500 for automated releasing of sorted mail items in the mailbox assembly 100 for collection by the user. The method 500 includes a step 502 of receiving, by the control device 110, user input data from the user for collecting one or more mail items stored in one or more storage units 140. The method 500 includes a step 504 of verifying, using the control module of the mailbox assembly 100, 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 one or more identifiers of the one or more storage units 140 having the one or more mail items stored therein.

In some embodiments, the step 504 of verifying the user input data includes receiving, by the control module, the user reference data from the remote server 420.

For example, the remote server 420 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.

5

In some embodiments, the step 504 of verifying the user input data includes sending, using the control module, the user input data to the remote server 420 for verification of the user input data. The step 504 further includes receiving, by the control module, a verification message from the remote server 420 indicating that the user input data
10 has been successfully verified, the verification message including the identifiers of the one or more storage units 140.

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 440. The OTP may be sent
15 from the remote server 420 to the user electronic device 440 via a messaging service such as SMS. The control device 110 may include a touch panel, keyboard, and/or keypad, for the user to enter the OTP. The remote server 420 would be able to verify the OTP and determine that the user is the intended recipient of the mail items. Alternatively, the remote server 420 also sends the OTP to the mailbox
20 assembly 100 to serve as the reference input data. 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
25 the remote server 420 and displayed on the app. The control device 110 may include a scanner device for reading the optical code. Alternatively, the remote server 420 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.

30

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. The user may request for a fresh OTP / optical code.

In another example, the user input data is an electronic signal, such as an NFC or RFID signal, sent from the user electronic device 440. The control device 110 may include a sensor for detecting the electronic signal. The electronic device 440 may be pre-registered with the remote server 420 to provide a specimen copy of the electronic signal for verification. Alternatively, the remote server 420 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 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 420 to provide a specimen copy of the identity data and/or facial recognition data as the reference input data for verification by the remote server 420.

The user input data may further include details of the 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 control device 110. These additional details are recorded on the remote server 420 during the pre-registration and are thus verifiable by the remote server 420. These additional details may be included in the user reference data for local verification by the mailbox assembly 100. These additional details serve as an added security measure to verify that the user is the intended recipient of the mail items addressed to this mailing address.

The method 500 includes a step 506 of opening, using the control module, the one or more storage units 140 based on the identifiers of the one or more storage units 140 in response to verification of the user input data. More specifically, the control module sends a signal to the respective control panels 166 of the respective storage unit assemblies 160 to open the identified storage units 140, thereby releasing the mail items for collection by the user. As mentioned above, the mail items may be

dropped into the collection chute 182 and the user can collect the mail items from the collection unit 180.

With reference to Figure 12, there is a process 600 for automated sorting and releasing of mail items in the mailbox assembly 100. The process 600 includes various steps performed by the mailbox assembly 100, remote server 420, and an electronic device 440 of a user collecting the mail items from the mailbox assembly 100.

In a step 602, the mailbox assembly 100 receives a batch of mail items when the mail carrier loads them to the loading units 120. In a step 604, the mailbox assembly 100 receives, from the remote server 420, the mail reference data associated with the address labels of the mail items. Preferably, the mail reference data for one day's batch of mail items can be sent and preloaded to the mailbox assembly 100 daily, such as at the start of the day, to reduce continual or periodic communications between the remote server 420 and the mailbox assembly 100.

In a step 606, the carriage assembly 200 begins transferring the mail items from the loading units 120 to the storage units 140. During this transfer, in a step 608, when the mail item has been placed at the tray transfer assembly 260, the imaging device 220 scans the address labels of the mail items to match against the mail reference data.

The address label of a mail item has an optical code readable by the imaging device 220, such as a data matrix code or QR code. The optical code may be printed onto the mail item, such as on a margin of the envelope. In one embodiment, the optical code is encoded with the mailing address and the control module can decode the optical code to extract the mailing address. In another embodiment, the optical code may be a barcode that is encoded with an identifier, such as a string of characters, associated with the mailing address. The optical code can be decoded to extract the identifier which can then be matched against the mail reference data.

In step 610, the control module processes the optical code to decode the optical code for matching against the mail reference data. In a step 612, the control module checks the mail reference data and matches the scanned address label, specifically the decoded optical code, against the mail reference data. In a step 614, the control module allocates a storage unit 140 to the mail item based on the matched address label. In a step 616, the carriage assembly 200 completes transferring the mail item to the allocated storage unit 140. The carriage assembly 200 continues to transfer the remaining mail items.

Thus, mail items with address labels that can be successfully matched against the mail reference data would be sorted to their allocated storage units 140. In some cases, some mail items have address labels that cannot be matched against the mail reference data. For example, the address label may represent a mailing address that does not exist in the building where the mailbox assembly 100 is installed. These unmatched mail items may be discarded to or temporarily held in the rejection unit to await further processing.

In some embodiments, the address label of a mail item has the mailing address in a written form, e.g. handwritten or typewritten. The imaging device 220 and control module may be configured with optical character recognition (OCR) technology to read the written mailing address. The read mailing address can be matched against known mailing addresses of the building where the mailbox assembly 100 is installed. This OCR scanning of the mailing address serves as an additional check on whether the mail item was delivered to the correct mailbox assembly 100 before sorting the mail item. For example, if the OCR check fails, the mail item may be discarded to or temporarily held in the rejection unit to await further processing.

In a step 618, after the mail items have been successfully transferred to the respective allocated storage units 140, the mailbox assembly 100 sends a confirmation message to the remote server 420. The confirmation message includes identifiers of the allocated storage units 140 that are associable with the address labels of the mail items stored therein. In one embodiment, the mailbox assembly 100 sends the confirmation message after each mail item has been successfully

transferred. In another embodiment, the mailbox assembly 100 sends the confirmation message after the batch of mail items has been successfully transferred.

In a step 620, the remote server 420 sends a notification message to the user electronic device 440 to inform the user that he/she has new mail items stored in the mailbox assembly 100. The notification message may be sent to the app on the user electronic device 440. Alternatively, or additionally, the notification message may be sent via a messaging service (e.g. SMS) and/or email to the user. The remote server 420 may obtain contact details of the user, such as phone number or email address, from the pre-established database. Optionally, the remote server 420 may send the notification messages to the respective users in the step 620 after all the mail items have been sorted and stored in the storage units 140. For example, the notification messages are collectively sent at the end of the day.

After receiving the notification message which may be displayed on the app executed on the user electronic device 440, the user goes to the mailbox assembly 100 to collect the mail items. In a step 622, the user uses the app to send a request to the remote server 420 for an OTP or one-time optical code. In a step 624, the remote server 420 processes the request and generates the OTP or optical code. In a step 626, the remote server 420 sends the OTP or optical code to the user electronic device 440. In a step 628, the remote server 420 sends the OTP or optical code to the mailbox assembly 100 for local verification of the user input data by the mailbox assembly 100.

In a step 630, the mailbox assembly 100, specifically the control device 110 thereof, receives the user input data, such as from the user electronic device 440. In one example, the user input data includes the OTP and is entered by the user on the control device 110. In another example, the control device 110 reads the optical code displayed on the user electronic device 440. Optionally, the control device 110 may prompt the user to enter additional details for verification, such as mail address details or contact details.

In a step 632, the mailbox assembly 100 verifies, using the control module, the user input data against the user reference data. The user reference data includes the reference input data from the OTP or optical code received in the step 628, as well as the identifiers of the respective allocated storage units 140. The identifiers may be determined from the confirmation message in the step 618.

In some embodiments, the user uses an NFC or RFID signal, such as from the user electronic device 440, to collect the mail items. The control device 110 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 420 for verification. The user input data may include user identity data and/or facial recognition data. Upon verification of the user input data by the remote server 420, the remote server 420 returns a verification message including the identifiers of the respective allocated storage units 140.

In a step 634, the allocated storage units 140 identified based on the identifiers in the verification message are automatically opened in response to verification of the user input data, thereby releasing the mail items to the collection unit 180. Optionally, the control device 110 may prompt the user to confirm whether to open the allocated storage units 140. The user then proceeds to collect the mail items from the collection unit 180. In a step 636, the mailbox assembly 100 may send a collection message to the remote server 420 to confirm that the mail items have been collected.

As described in various embodiments herein, at least the system 400 and the process 600 provide many 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 items to the mailbox assembly 100 as the mail carrier does not need to manually sort out the mail items by the mailing addresses. Instead of spending 20 minutes currently for manual sorting, the mail carrier may spend just 2 minutes to load the same batch of mail items by their sizes to the loading units 120. By reducing the time spent for a mailbox assembly 100, the mail carrier can deliver mail items 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 to be done.

- 5 As the mail carrier only needs to access the loading units 120, only the loading units 120 need to be positioned at ergonomic heights. Other parts of the mailbox assembly 100, particularly the storage units 140, can be expanded upwards to maximize the overall height and capacity of the mailbox assembly 100. More storage units 140 can be installed for storing a larger number of mail items.

10

Another advantage is the traceability of mail items from delivery by the mail carrier to collection by the users. Electronic records are kept by the remote server 420 when new mail items arrive at the mailbox assembly 100 and when mail items are collected by the users. Postal companies can analyze the electronic records to
15 monitor and trace the mail items, including ordinary mail, and obtain information such as whether the mail items are delivered timely. Postal companies can also rely on these electronic records for future verification or auditing purposes.

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

- In the foregoing detailed description, embodiments of the present disclosure in
30 relation to a mailbox assembly for automated sorting 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 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
5 modifications can be made to the disclosed embodiments without departing from the scope of the present disclosure. Therefore, 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 sorting of mail items, the mailbox assembly comprising:

5 a number of loading units for loading a batch of mail items, each mail item comprising an address label representing a mailing address;

a plurality of storage units for storing the mail items for subsequent collection;

10 a carriage assembly for transferring the mail items from the loading units to the storage units;

an imaging device for scanning the address labels on the mail items; and

a control module configured for:

15 receiving mail reference data associated with the address labels of the batch of mail items;

matching the scanned address labels against the mail reference data; and

allocating a respective storage unit to each mail item based on the matched address label,

20 wherein the carriage assembly is configured for transferring each mail item to the respective allocated storage unit.

2. The mailbox assembly according to claim 1, each loading unit comprising an object sensor disposed at a top end of the loading unit, the object sensor configured
25 to detect presence of a mail item at the top end.

3. The mailbox assembly according to claim 2, each loading unit comprising air curtains for airflow to separate the mail item at the top end from other mail items.

30 4. The mailbox assembly according to any one of claims 1 to 3, the carriage assembly comprising a picking mechanism for picking the mail items, the picking mechanism comprising a picking member operative by vacuum suction.

5. The mailbox assembly according to any one of claims 1 to 4, the carriage assembly comprising a height sensor for estimating height of the mail items.

6. The mailbox assembly according to claim 5, wherein the control module is configured for allocating a respective storage unit to each mail item based additionally on the estimated height of the mail items.

7. The mailbox assembly according to any one of claims 1 to 6, the carriage assembly comprising a transfer tray assembly for holding the mail items during transfer from the loading units to the storage units.

8. The mailbox assembly according to claim 7, the transfer tray assembly comprising a tray member slidable and tiltable to drop the mail items into the storage units.

9. The mailbox assembly according to claim 8, the transfer tray assembly comprising a clamping mechanism for clamping the mail items on the tray member.

10. The mailbox assembly according to any one of claims 1 to 9, further comprising one or more collection units, wherein the storage units are configured to release the mail items to the collection units.

11. The mailbox assembly according to any one of claims 1 to 10, further comprising a control device communicative with the control module and configured for receiving user input data from a user collecting the mail items.

12. The mailbox assembly according to any one of claims 1 to 11, wherein the imaging device is configured for reading written mailing addresses on the mail items using optical character recognition (OCR).

13. A method for automated sorting of mail items in a mailbox assembly, the method comprising:

receiving the mail items in number of loading units of the mailbox assembly, each mail item comprising an address label representing a mailing address;

receiving mail reference data associated with the address labels of the mail items; and

for each mail item:

scanning the address label on the mail item using an imaging device of the mailbox assembly;

matching, using a control module of the mailbox assembly, the scanned address label against the mail reference data;

allocating, using the control module, a respective one of a plurality of storage units of the mailbox assembly to the mail item based on the matched address label; and

transferring, using a carriage assembly of the mailbox assembly, the mail item from the loading units to the respective allocated storage unit.

14. The method according to claim 13, wherein the address label comprises a machine-readable optical code, said scanning of the address label comprising decoding the optical code.

15. The method according to claim 13 or 14, further comprising, for each mail item, reading a written mailing address on the mail item by the imaging device using optical character recognition (OCR).

16. The method according to any one of claims 13 to 15, wherein the mail reference data is sent from a remote server to the mailbox assembly.

17. A method for automated releasing of sorted mail items in a mailbox assembly for collection by a user, the method comprising:

receiving, by a control device of the mailbox assembly, user input data from the user for collecting one or more mail items stored in one or more storage units of the mailbox assembly;

verifying, using a control module of the mailbox assembly, the user input data against the user reference data comprising one or more identifiers of the one or more storage units; and

5 opening, using the control module, the one or more storage units based on the identifiers in the verification message, thereby releasing the one or more mail items stored therein for collection by the user.

18. The method according to claim 17, wherein said verifying of the user input data comprises:

10 receiving, by the control module, the user reference data from a remote server; and

 verifying, by the control module, the user input data against the user reference data locally.

15 19. The method according to claim 17, wherein said verifying of the user input data comprises:

 sending, using the control module, the user input data to a remote server for verification of the user input data; and

20 receiving, by the control module, a verification message from the remote server indicating that the user input data has been successfully verified, the verification message comprising the identifiers of the one or more storage units.