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MAIL DISPENSER SYSTEM WITH SORTERS

Field of the Invention

- 5 The present invention relates to a mail dispenser system which is configured to sort mail.

Background

- 10 In recent times, there has been substantial growth in E-commerce due to factors like widespread use of smartphones, ready access to high-speed data networks, changes in consumer behaviour due to lockdowns, and so forth. The purchase of goods and services via online merchants has become increasingly mainstream globally.
- 15 Typically, “last mile delivery” of such purchases provide challenges for most E-commerce companies and their delivery providers. In Singapore there are several collaborations formed by some of these companies to solve their “last mile delivery” issues, typically by leveraging on each other’s expertise and pooling resources while working with government agencies to bolster such capabilities.

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One example of such a collaboration in Singapore relates to the installation of enhanced lockers island-wide. Typically, human-assisted sorting for each locker is required, before a user is able to collect their mail/package from an allocated locker.

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It should be appreciated that an on-site sorting process requires time to be carried out without any guarantees on accuracy of the sorting. In addition, the footprint required for such a system is substantial, and the space is not optimised due to human height/reach limitation issues during sorting and collection of contents from each
5 locker.

In addition, many national postal entities are also facing challenges in maintaining profitability due to the reduction in snail mail volume, competition from private courier operators, and difficulties in maintaining sufficient numbers of suitable staff.

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In view of the challenges indicated in the preceding paragraphs, it is noted that an improved mail sorting system will be helpful to mitigate the challenges that currently exist.

15 **Summary**

In a first aspect, there is provided a mail dispenser system, the system comprising:

a casing;

a magazine placed within the casing, the magazine being configured for storing

20 mail; and

a plurality of trays placed within the magazine, each tray including a movable base.

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It is preferable that the movable base is configured to be actuated to dispense objects placed on each tray.

In a second aspect, there is provided a mail dispenser system, the system being
5 configured to carry out the steps comprising:

activating, at least one safety sensor, to prevent blockage for a movement of a robotic assembly;

verifying, at a visual indicia reader, an appropriate position for movement of the robotic assembly;

10 gripping, by a tray grip of the robotic assembly, a tray from a magazine;

capturing, by an image capture apparatus, at least one image of objects on the tray; and

toggling, a base of the tray to dispense the objects.

15 It will be appreciated that the broad forms of the invention and their respective features can be used in conjunction, interchangeably and/or independently, and reference to separate broad forms is not intended to be limiting.

Brief Description of the Drawings

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A non-limiting example of the present invention will now be described with reference to the accompanying drawings, in which:

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FIGs 1A to 1D provide different views of an embodiment of a mailbox dispenser system of the present invention;

FIGs 2A to 2E provide different views of a magazine used in a mailbox dispenser system of the present invention;

- 5 FIG 3 provides a perspective view of a tray used in a mailbox dispenser system of the present invention;

FIGs 4A to 4D provide different views of a robotic assembly used in a mailbox dispenser system of the present invention;

FIG 5 provides the process flow for a method of sorting mail;

- 10 FIGs 6A to 6D provide different views of a second embodiment of a mailbox dispenser system of the present invention.

Detailed Description

- 15 There is provided a mailbox dispenser system configured to sort and dispense mail items. The system is constructed in a manner which allows for easy access by users, and does not have a substantial footprint, so it can be installed in locations with space constraints. Due to the low space requirement, the mailbox dispenser system can be deployed in multiple locations, providing a versatile deployment option for mail
- 20 dispensing. In addition, the mailbox dispenser system need not be a permanent installation and can be moved to a wide range of locations.

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Referring to FIG 1A, there is shown a front view of an embodiment of a mailbox dispenser system 100. The system 100 comprises a casing 105 made from a material which is able to protect the contents stored within the casing 105 from theft, tempering and damage. The casing 105 is shown to rest on legs 110, and in some embodiments, 5 the legs 110 can include rollers which can be configured to enable convenient movement of the system 100. The system 100 also includes a collection receptacle 115, the collection receptacle 115 being a location for holding and consolidating mail for users after the users have been verified. The system 100 also includes a user interface panel 120, the user interface panel 120 being configured to verify an identity 10 of a user using at least one of, for example, a touch panel display 125, a camera 130 configured for facial recognition, a sensor 135 configured to read QR codes and/or receive RFID signals, and so forth.

Referring to FIG 1B, there is shown a cross-sectional side view of the system 100 of 15 FIG 1A. Common features from FIG 1A are identically labelled in FIG 1B and may not be referred to. There is shown a near range field of scanning 140 for the sensor 135, and near range is also desired for the facial recognition capability of the camera 130. The system 100 also includes a central rack 145 which is configured to be able to support a substantial load comprising other parts of the system 100 like a magazine 20 150. The central rack 145 should be able to support a load from the magazine 150. The system 100 also includes a robotic assembly 155. The robotic assembly 155 is mounted to a side rail 148. The magazine 150 is configured to store mail prior to collection from users, while the robotic assembly 155 is configured to process mail

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handled by the system 100. Further details of the magazine 150 and the robotic assembly 155 will be provided in subsequent sections.

Referring to FIG 1C, there is shown a front view of the system 100 of FIG 1A. However,
5 some of the internal parts of the system 100 is shown to aid in describing the system 100. Common features from the preceding FIGs are identically labelled and may not be referred to. It should be noted that the robotic assembly 155 is movable in order to operate in a desired manner, and as such, is shown to be in a different location in FIG 1C compared to FIG 1B.

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Referring to FIG 1D, there is shown an x-ray view of the system 100 of FIG 1A. It should be noted that a position of the robotic assembly 155 is similar to what is shown in FIG 1B. Common features from the preceding FIGs are identically labelled and may not be referred to.

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Referring to FIGs 2A to 2D, there is shown different views of a magazine 150 as referred to in FIG 1. The magazine 150 includes an open end 180 and top sealed end 185. The open end 180 allows placement of a plurality of trays 170. FIG 2A shows a perspective view of the magazine 150 when it is not loaded with any trays 170.

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The magazine 150 is configured to enable a layered placement of the plurality of trays 170 using a plurality of ledges 175 configured to allow the trays to rest on them. The plurality of ledges 175 are equidistant from each other. It should be noted that the

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plurality of ledges 175 can be customised in relation to height and/or pitch. The trays 170 are configured to contain/store mail items processed by the system 100. For example, a height of the trays 170 can range from 10mm to 40mm. The trays 170 placed in the magazine 150 can be of similar/identical heights as shown in FIG 2B or
5 different heights as shown in FIG 2C. For example, a tray of single height takes a magazine slot whereas twice the tray height occupies two magazine slots. Correspondingly, the higher the tray height, the higher the number of magazine slots being taken up.

10 For the sake of illustration, FIG 2B shows a frontal view of the magazine 150 fully loaded with a plurality of trays 170 with the same tray height. FIG 2C shows a frontal view of the magazine 150 fully loaded with a plurality of trays of different heights.

FIG 3 shows a perspective view of the tray 170, although it should be appreciated that
15 the tray 170 can be provided with different widths/heights/depths. The tray 170 includes a frame 305 for maintaining structural integrity for the tray 170, and for resting on the ledges 175 of the magazine 150. The frame 305 includes a stopper 310. The stopper 310 is configured to allow the tray 170 to remain within the magazine 150 when the tray 170 is being moved within the magazine 150. The tray 170 also includes
20 a movable base/bottom cover 315, the purpose of the movable base 315 being evident when the operation of the system 100 is described.

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FIG 2D shows a perspective view of the magazine 150 with a single tray 170 fully extended from the magazine 150, and FIG 2E shows a side view of FIG 2D when the movable base 315 of the tray 170 drops upon application of a force. It should be appreciated that FIG 2E occurs in a state of the tray 170 shown in FIG 2D.

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Both the tray 170 and the magazine 150 can be fabricated from light but rigid materials such as, for example, aluminium plastic, bakelite and so forth. Both the tray 170 and the magazine 150 should be labelled with unique visual indicia to facilitate identification and tracking by the robotic assembly 155 of the system 100. The unique
10 visual indicia can be adhered to the tray 170 and the magazine 150 on a label.

Typically, the magazine 150 is placed into the system 100 already with multiple pre-loaded trays 170. Pre-sorting of mail items in each tray 170 can be carried out at a dedicated station either automatically or manually. Heavy/bulky mail items can be
15 placed directly on each tray 170 which is already in the magazine 150. A detailed record for each magazine 150 and tray 170 is provided. It can be optional to provide multiple mail item IDs (when available) within each tray 170, as well as user parameter details for each tray 170 for trackability. A user can be a recipient mail items on either single or multiple trays 170, spread across at least one magazine 150. The system
20 100 is configured to validate all newly arrived magazines 150 and trays 170 by its ID's against both current and newly received records. This includes trays 170 that have been removed from magazines 150 and placed back after removal.

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For example, any magazine 150 removed from the system 100 and put back is considered newly arrived. Similarly, any tray 170 removed from the magazine 150 and placed back into the magazine 150 is considered newly arrived. Any previously loaded magazine(s) 150 can allow placement of trays 170 from other magazines 150. It should be noted that any emptying of a tray 170 leads to deletion of the associated database record to it so that new magazines 150 can be included. Depending on the capacity requirements for the mailbox system, a base of the casing 105 can be expanded to accommodate a greater number of magazines 150.

Referring to FIGs 4A to 4D, there is shown different views of the robotic assembly 155 as referred to in FIG 1. It should be noted that the robotic assembly 155 and the side rail 148 can be varied for optimal utilisation of space within the system 100. The robotic assembly 155 is mounted to the side rail 148. The side rail 148 can be mounted to a wall of the casing of FIG 1. The robotic assembly 155 is configured to move along the side rail 148 in a vertical orientation within the casing 105. When robotic assembly 155 moves vertically, the robotic assembly 155 is configured to index a location and/or starting points of each tray 170 and each magazine 150 in order to perform validation and for dispensing tasks. For example, when a new magazine 150 is loaded to the system 100, the new magazine 150 will need to be validated with data of a host system.

The robotic assembly 155 includes a visual indicia reader 405, the reader 405 being configured to detect the unique visual indicia being adhered to the tray 170 and the

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magazine 150. The visual indicia reader 405 is located at either side arm 410 of the robotic assembly 155 or front-facing.

The robotic assembly 155 also includes a pair of tray engagement mechanisms 415.

5 Each tray engagement mechanism 415 is configured to move the tray 170, as well as actuate the movable base 315. Each robotic assembly 155 includes a tray grip 420 located at the sides or front-facing, which is configured to latch onto a tray 170. The tray grip 420 is able to move the tray 170 outwards from the magazine 150 and in doing so, a base presser 425 is actuated in a way which applies a force to the movable
10 base 315 of the tray 170. When the bottom cover/movable base 315 drops, mail contained in the tray 170 is correspondingly dropped. In some embodiments, the bottom cover/movable base 315 includes ribs to reduce surface area in contact with objects placed on the tray 170 and to enable air flow in channels defined by the ribs.

15 In some embodiments, at least one air nozzle 430 is included with the robotic assembly 155 to enable quick and positive dispensing of mail by blowing compressed air. When the base presser 425 returns to the initial position, the bottom cover/movable based 315 also returns to the initial position. When the tray grip 420 returns to the initial position, the tray 170 is then returned to it's previous position within
20 the magazine 150.

The robotic assembly 155 can also include at least one safety sensor 435 configured to detect whether any of the trays 170 have been dislodged from the magazine 150

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before robotic assembly 155 traverses in a vertical plane. If there are two safety sensors 435, one can face upwards and the other can face downwards. The robotic assembly 155 can also include a camera 440 configured to determine the presence of items in the tray 170 and to detect and confirm empty trays 170 after mail items
5 have been dispensed.

Referring to FIG 5, the process flow is provided for a method 500 of dispensing mail using the apparatus 100.

10 At step 505, the at least one safety sensor 435 is activated to ensure that there is no blockage during movement of the robotic assembly 155.

At step 510, the robotic assembly 155 moves to an appropriate position/height and the position/height is verified using the visual indicia reader 405.

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At step 515, the tray grip 420 engages with the tray 170 to slide the tray 170 out of the magazine 150 (the stopper 310 prevents the tray 170 from sliding out of the magazine 150).

20 At step 520, the camera 440 is activated to capture at least one image of mail items within the tray 170 for mail tracking purposes.

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At step 525, the base presser 425 is actuated to engage with the movable base 315 of the tray 170 to toggle the movable base 315 to an open position so that the mail items are dispensed.

- 5 At step 530, the at least one air nozzle 430 is activated to generate a gust of air to enable faster dispensing of mail items to the collection receptacle 115.

At step 535, the movable base 315 reverts to a closed position within a few seconds after step 525 to enable the camera 440 to ensure no mail contents remain. If mail
10 contents remain, an error indication is provided.

At step 540, the tray grip 420 engages with the tray 170 to slide the tray 170 into the magazine 150.

- 15 After step 540, the method 500 then starts from step 505 again.

The system 100 and method 500 provide users with an effective “last mile delivery” solution, which is scalable, and can be configured to be used in available real estate. In addition, the accuracy of mail being dispensed is verified using sensors, which is
20 useful in minimising human error and improving productivity.

Referring to FIGs 6A and 6D, there is shown a second embodiment of the system 100. The second embodiment differs from the earlier described embodiment as each

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magazine 150 is accessible via a rear access door 650. The rear access door 650 enables loading and unloading of each magazine 150 respectively, which can be advantageous when mass loading/unloading of the magazines 150 in the system 100 is not allowable or where different entities are using the system 100, such as, for
5 example, postal organisations, commercial couriers, and so forth.

There is also shown a document dispenser 600 that is accessible via a dedicated door 660. The document dispenser 600 can be used for the distribution of, for example, flyers, brochures, notices, and so forth, particularly where different entities require
10 secured access to the dispenser 600, for example, postal organisations, commercial couriers, and so forth.

Throughout this specification and claims which follow, unless the context requires otherwise, the word “comprise”, and variations such as “comprises” or “comprising”,
15 will be understood to imply the inclusion of a stated integer or group of integers or steps but not the exclusion of any other integer or group of integers.

Persons skilled in the art will appreciate that numerous variations and modifications will become apparent. All such variations and modifications which become apparent
20 to persons skilled in the art, should be considered to fall within the spirit and scope that the invention broadly appearing before described.

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THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A mail dispenser system, the system comprising:
 - a casing;
 - 5 a magazine placed within the casing, the magazine being configured for storing mail;
 - a plurality of trays placed within the magazine, each tray including a movable base; and
 - wherein the movable base is configured to be actuated to dispense objects
 - 10 placed on each tray.
2. The system of claim 1, wherein the placement of the plurality of trays can be varied.
- 15 3. The system of either claim 1 or 2, wherein removal of each of the plurality of trays is carried out to dispense objects placed on each tray.
4. The system of claim 3, further including a robotic assembly being configured for removal of each of the plurality of trays.
- 20 5. The system of any of claims 1 to 4, wherein the magazine and each of the plurality of trays is labelled with visual indicia.

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6. The system of any of claims 1 to 5, wherein pneumatic methods are used to aid in dispensing the objects.

7. The system of any of claims 1 to 6, wherein the movable base includes ribs to
5 reduce surface area in contact with the objects and to enable air flow in channels defined by the ribs.

8. The system of any of claims 1 to 7, wherein actuation of the movable base is enabled by a base presser.

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9. The system of any of claims 1 to 8, further including at least one camera configured to determine a presence of objects in the tray and to determine an empty tray.

15 10. The system of claim 4, further including at least one safety sensor configured to ensure non-blockage during movement of the robotic assembly.

11. The system of any of claims 1 to 10, further including a plurality of rear access doors that enable access to independent magazines.

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12. The system of any of claims 1 to 11, further including a document dispenser accessible by a secured door.

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13. A mail dispenser system, the system being configured to carry out the steps comprising:

activating, at least one safety sensor, to prevent blockage for a movement of a robotic assembly;

5 verifying, at a visual indicia reader, an appropriate position for movement of the robotic assembly;

gripping, by a tray grip of the robotic assembly, a tray from a magazine;

capturing, by an image capture apparatus, at least one image of objects on the tray; and

10 toggling, a base of the tray to dispense the objects.