UAV BALCONY DELIVERIES TO MULTI-LEVEL BUILDINGS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is based on U.S. Application No. 16/703,170, filed December 4, 2019, the content of which is hereby incorporated by reference in its entirety.

TECHNICAL FIELD

[0002] This disclosure relates generally to unmanned aerial vehicles (UAVs), and in particular but not exclusively, relates to the use of UAVs for deliveries of packages.

BACKGROUND INFORMATION

[0003] Drone delivery is positioned to change the way lightweight goods are moved between locations (e.g. from retailer to consumer). However high-density urban spaces, particularly multi-level buildings, present a challenge to aircraft that are attempting to make a delivery. The most straightforward and desirable delivery approaches have an unobstructed path for the drone to follow during its route to drop off a package, which is challenging to identify and allocate in high-density urban spaces. The challenge of identifying the correct delivery destination is particularly acute for urban apartment residences that are tightly situated with low incidence of externally distinguishing features. Compounding the problem is the navigational challenge of maneuvering inside the "urban canyon" where traditional navigation methods (e.g. GPS) are unreliable.

SUMMARY OF INVENTION

[0003a] According to an aspect of the present invention, there is provided a computer-implemented method for validating a balcony of a multi-level building comprising multiple balconies to receive aerial delivery of a parcel via an unmanned aerial vehicle (UAV), the method comprising:

obtaining, via a computing device, a first identification of a general location of the balcony, wherein the computing device is a computing device of an end-user;

generating, for display on the computing device, a first image representing the multi-level building, wherein the multi-level building includes the balcony and the first

image is selected based upon the general location identified by the end-user, wherein generating the first image representing the multi-level building comprises providing a visual model of a side of the multi-level building that includes the balcony; obtaining, via the computing device, a second identification or a confirmation of a precise location of the balcony in the multi-level building, wherein the second identification or the confirmation are received in response to an end-user interaction with the first image;

determining a deliverability score based at least in part on the precise location of the balcony; and

indicating an enrollment status to the end-user, via the computing device, the enrollment status generated based upon the deliverability score.

[0003b] There is disclosed at least one machine-accessible storage medium that provides instructions that, when executed by a machine, will cause the machine to perform operations comprising:

obtaining, via a computing device, a first identification of a general location of a balcony to receive delivery of a parcel via an unmanned aerial vehicle (UAV);

generating, for display on the computing device, a first image representing a building, wherein the building includes the balcony and the first image is selected based upon the general location identified by the end-user;

obtaining, via the computing device, a second identification or a confirmation of a precise location of the balcony in the building, wherein the second identification or the confirmation are received in response to an end-user interaction with the first image;

determining a deliverability score based at least in part on the precise location of the balcony; and

indicating an enrollment status to the end-user, via the computing device, the enrollment status generated based upon the deliverability score.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] Non-limiting and non-exhaustive embodiments of the invention are described with reference to the following figures, wherein like reference numerals refer to like parts throughout the various views unless otherwise specified. Not all instances of an element are necessarily labeled so as not to clutter the drawings where appropriate.

The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the principles being described.

CLAIMS

What is claimed is:

1. A computer-implemented method for validating a balcony of a multi-level building comprising multiple balconies to receive aerial delivery of a parcel via an unmanned aerial vehicle (UAV), the method comprising:

obtaining, via a computing device, a first identification of a general location of the balcony, wherein the computing device is a computing device of an end-user;

generating, for display on the computing device, a first image representing the multi-level building, wherein the multi-level building includes the balcony and the first image is selected based upon the general location identified by the end-user, wherein generating the first image representing the multi-level building comprises providing a visual model of a side of the multi-level building that includes the balcony;

obtaining, via the computing device, a second identification or a confirmation of a precise location of the balcony in the multi-level building, wherein the second identification or the confirmation are received in response to an end-user interaction with the first image;

determining a deliverability score based at least in part on the precise location of the balcony; and

indicating an enrollment status to the end-user, via the computing device, the enrollment status generated based upon the deliverability score.

2. The computer-implemented method of claim 1, wherein the enrollment status includes at least one of an enrollment rejected indication, an enrollment successful indication, or a flyby validation required indication.

3. The computer-implemented method of claim 1, further comprising:

receiving a picture captured with the computing device, wherein the picture is of the balcony or captured from the balcony; and

analyzing the picture for one or more of an obstruction to accessing the balcony or sufficient space on the balcony to deliver the parcel via the UAV,

wherein the deliverability score is further determined based at least in part on a combination of the picture and the precise location.

4. The computer-implemented method of claim 1, wherein the first identification of the general location of the balcony comprises a physical address of the multi-level building, and a unit number associated with the balcony, if any.

5. The computer-implemented method of claim 4, further comprising:

determining an initial altitude associated with the balcony based upon one or more of the first identification of the general location, the second identification of the precise location, or the confirmation of the precise location; and

instructing the UAV to hover at the initial altitude upon arriving in a vicinity of the balcony to commence searching for the balcony.

6. The computer-implemented method of claim 4, wherein the visual model includes a highlighted position determined to correspond to the end-user's balcony based on the obtained unit number associated with the balcony, and wherein the method comprises obtaining, via the computing device, the confirmation of the precise location of the balcony in the multi-level building.

7. The computer-implemented method of claim 1, wherein generating the first image representing the multi-level building further comprises

generating an aerial map image of a vicinity surrounding and including the multi-level building.

8. The computer-implemented method of claim 7, wherein obtaining the second identification comprises soliciting the end-user to indicate the precise location by touching a position on the aerial map image, the visual model, or the picture where the balcony is located.

9. The computer-implemented method of claim 1, further comprising:

acquiring a network identifier from the computing device, wherein the network identifier identifies a wireless network signal used by the computing device to wirelessly communicate with other computing devices; and

providing the network identifier to the UAV to aid in locating the balcony.

10. The computer-implemented method of claim 1, further comprising:

generating a fiducial marker;

associating the fiducial marker with the balcony or the end-user; and

providing the fiducial marker to the computing device for display from the balcony to aid the UAV in identification of the balcony.

11. The computer-implemented method of claim 10, further comprising:

informing the end-user, via the computing device, that the UAV has arrived in a vicinity of the balcony; and

requesting that the fiducial marker be displayed from the balcony for visual identification by the UAV.

12. The computer-implemented method of claim 1, further comprising:

informing the end-user, via the computing device, that the UAV has arrived in a vicinity of the balcony;

soliciting the end-user to provide directional feedback to the UAV for identification of a target delivery location on the balcony; and

registering the target delivery location for future deliveries to the balcony based at least in part upon the directional feedback.

13. The computer-implemented method of claim 1, further comprising:

providing a confirmatory image of the balcony to the end-user, the confirmatory image acquired by the UAV during a validation flyby; and

soliciting the end-user to validate the confirmatory image as correctly identifying the balcony.

14. At least one machine-accessible storage medium that provides instructions that, when executed by a machine, will cause the machine to perform the method of any one of claims 1-13.