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NALSAR UNIVERSITY OF LAW, HYDERABAD
P.G.DIPLOMA IN PATENTS LAW

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Annual Examinations (May, 2019)

Paper II – Practical
(Exploitation of Patents – Drafting, Specification & Patent Writing)

Time: 2 ½ hours. **TOTAL MARKS: 100**

INSTRUCTIONS TO CANDIDATES

1. **The question paper to be interpreted as given and no clarification can be sought from the invigilator.**
2. **Attempt only one choice – either A or B**
3. **Answers in illegible handwriting will not be taken into consideration.**

You are required to draft a complete specification containing; a.) Title of the Patent b.) Background of the Invention c.) Summary of the Invention d.) Claims e.) Abstract of the invention. (Do not write a detailed description or draw figures.)

The Claims in the patent draft carries 50 marks and remaining specification carries 50 marks.

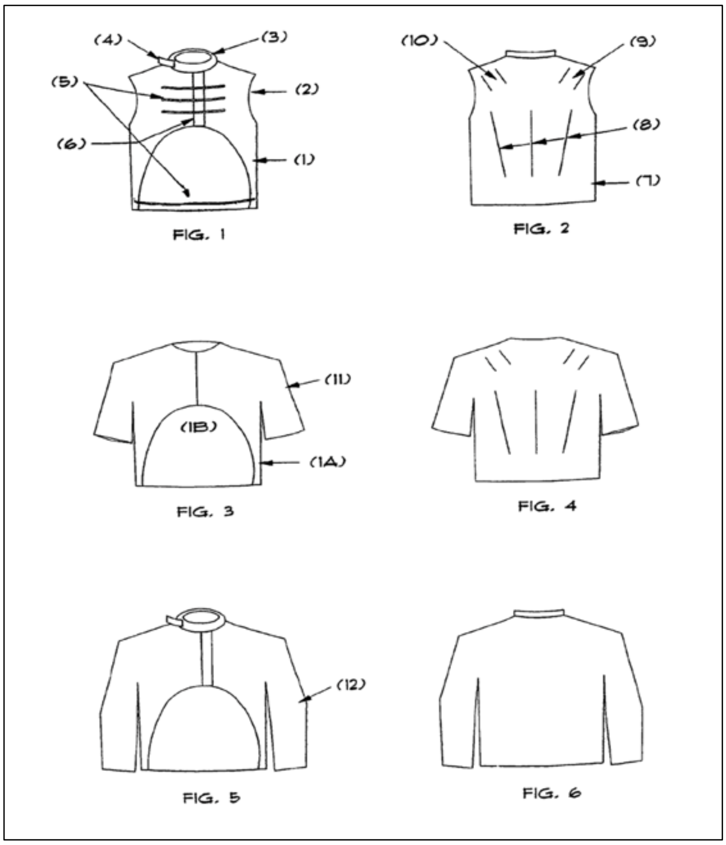
Option A

Mr. Marvin has developed a pain relieving vest or jacket which is made of fabric segments having differing material properties comprising of a plurality of longitudinal waves forming a fabric design arranged to provide the vest or jacket. The way the Pain Relieving Vest or Jacket works is when either is put on, there is 2 linear strips with hook and loop fastener lining in the front of the chest area for attachment and adjustable to the comfort of the individual user for compression desired. Also there can be a durable string or strap attachments (optional) for attachment and adjustable for the convenience and comfort of the user. The collar (optional) with foam insulation along with 2 linear strips with hook and loop fastener attachment to adjust compression in the neck area to the comfort of the individual user if needed. With the jacket it can be long or short sleeves. For long or short sleeves the compression will come from strong, breathable and lightweight compression fabric that feels good to the skin.

FIG. 1. Shows vest frontal view/RIGHT side of invention with 2 linear strips with hook and loop fastener lining starting from lower mid chest area up to collar area, with collar along with a 2 linear strip, hook and loop fastener attachment with foam insulation (optional). Included are 3 polyester string attachments or straps across the chest area. Also vest is shaped from bottom lower right and left sides of body frame, curved lining around the stomach up to beginning of chest area above abdominal area.

FIG. 2. Shows vest back view of invention.

FIG. 3. Shows jacket with frontal view/LEFT side without collar and attachment. Also shows opposite side as it would be under attachment in FIG. 1 of invention with short sleeves made of a compression material.



DRAWING REFERENCES

1. Vest frontal view/right side.
   1A. Vest frontal view/left side.
   1B. Vest frontal of lining going around the abdominal area from lower left to right sides.
2. No sleeves.
3. Collar.
4. Adjustable 2 linear strips with hook and loop fastener for collar attachment.
5. Locking polyester 3 string or strap attachments across the chest (optional).
6. Adjustable 2 linear strips with hook and loop fastener attachment Lining in chest area.
7. Vest back view.
8. Pliable metal stay or sheets (optional), 8 inches long.times.1/2 or so inches wide in lower to midsection of back or vertebrae.
9. Right shoulder area pliable metal stay or sheets (optional) 2 or more inches long.times.1/2 inches wide in back of vest.
10. Left shoulder area pliable metal stay or sheets (optional) 2 or more inches long.times.1/2 inches wide in back of vest.
11. Short sleeves.
12. Long Sleeves.

FIG. 4. Shows jacket with back view of invention with short sleeves without a collar, including pliable metal stay or sheets (optional).

FIG. 5. Shows jacket frontal view of invention with long sleeves and collar with 2 linear strips with hook and loop fastener attachments lining starting from the lower chest area up to collar. Also collar with a 2 linear strip, hook and loop fastener attachment with foam insulation (optional).

FIG. 6. Shows jacket back view of invention with long sleeves.

FIG. 1 Shows what the vest looks like from the front. It has 2 linear strips with hook and loop fastener lining up at the beginning of the lower chest area above the abdominal area up to the neck area to adjust to the user's comfort to compress any pain or discomfort in the upper to mid back, along with pain or discomfort in the shoulder, chest, and sides of the body areas. Also there are durable string cord or strap attachments (optional, for example made from polyester) to lock the garment in place for the convenience and comfort of the individual user. Also (optional) there is a collar for neck pains and 2 linear strips with hook and loop fastener attachment to compress that area for pain relief. The vest is shaped to go from the lower right and left sides of body frame up to the lower chest and around the abdominal area. The abdominal area when compressed can be uncomfortable while sitting, especially after eating.

FIG. 2 Shows what the vest looks like from the back. Within the lower to upper area of the back there are just for illustration 3 pliable metal stay or sheets for the back area for support and 2 pliable metal stay or sheets on the left and right side of the shoulder area for support.

Jackets can be long sleeve or short sleeve depending on the individual choice. Sizes will vary from small, medium, to large and if necessary small for kids and extra-large for individuals who require extra large size.

The advantages of the invention is that it will be able to treat the pain or discomfort areas without having to wear two or more different devices. It will treat the back (upper to mid extremities), shoulder area, chest, sides of the body and neck, plus upper and lower arm areas (optional). It can be a vest or a jacket, long or short sleeve, and not only be adjustable by 2 linear fabric strips with hook and loop fastener lining attachment but with polyester string cord or straps that loops or hooks to lock garment in place to make it more efficient for the individual user. Also just as important, it will not bring discomfort to the abdominal area while wearing it, unlike some or maybe most back support devices/compression garments on the market today because the abdominal area is not covered when wearing the garment design.

<u>Option B</u>

Mr Nathan has developed a collective UAV in which multiple UAVs may be coupled together to form the collective UAV. A collective UAV may be used to aerially transport virtually any size, weight or quantity of items, travel longer distances, etc. For example, rather than using one large UAV to carry a larger or heavier item, multiple smaller UAVs may couple together to form a collective UAV that is used to carry the larger or heavier item. UAVs (Unmanned Aerial Vehicles) are often designed to carry a payload and/or to remain airborne for a specified duration of time. For example, many multi-propeller aerial vehicles (e.g., quad-copters, octo-copters) are designed to carry a payload of up to ten pounds and remain airborne for up to thirty minutes. To carry larger payloads, the UAV typically has to be larger, with larger motors, larger propellers, and larger power modules to generate lifting forces sufficient to carry the larger payloads. Likewise, for extended flight duration, additional or larger power modules are typically necessary.

Mr Nathan uses the accompanying figures to explain his proposed invention. In the figures, the left-most digit(s) of a reference number identifies the figure in which the reference number first appears. The use of the same reference numbers in different figures indicates similar or identical items or features.

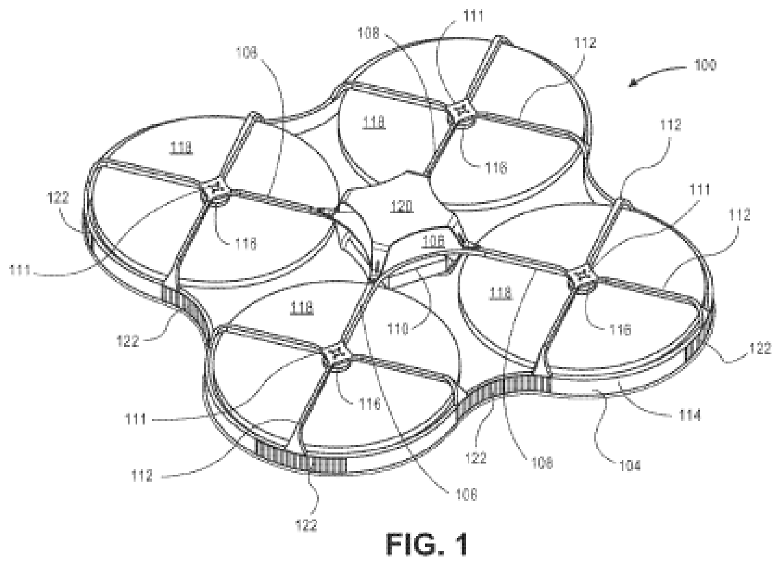


FIG. 1

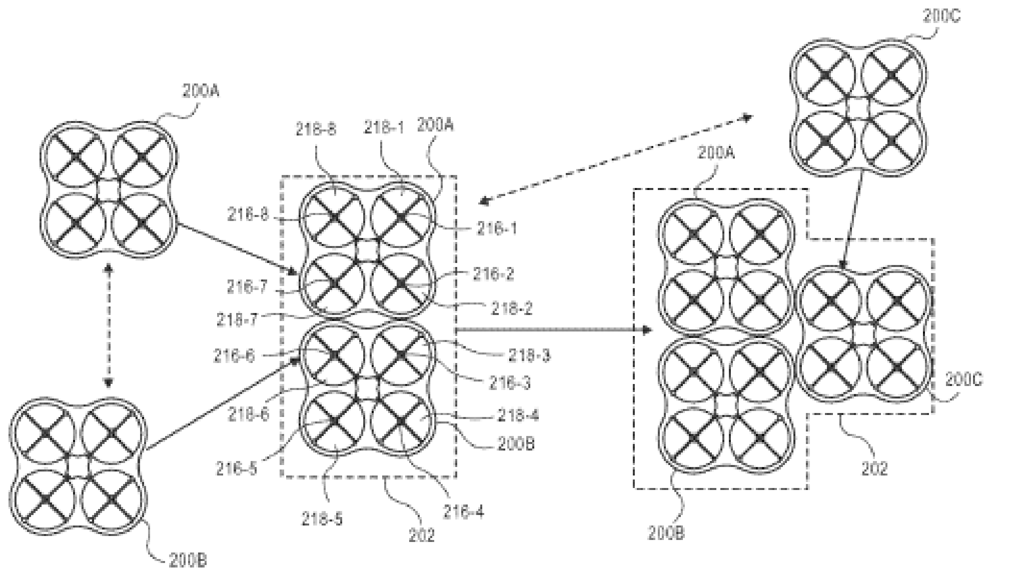


FIG. 2

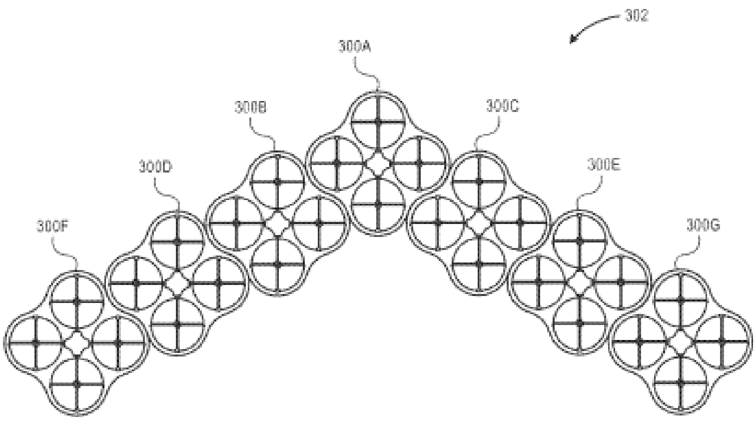


FIG. 3

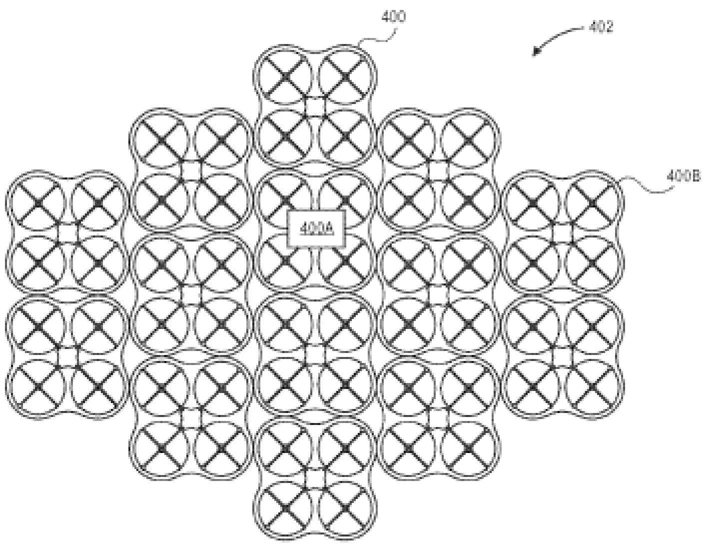


FIG. 4

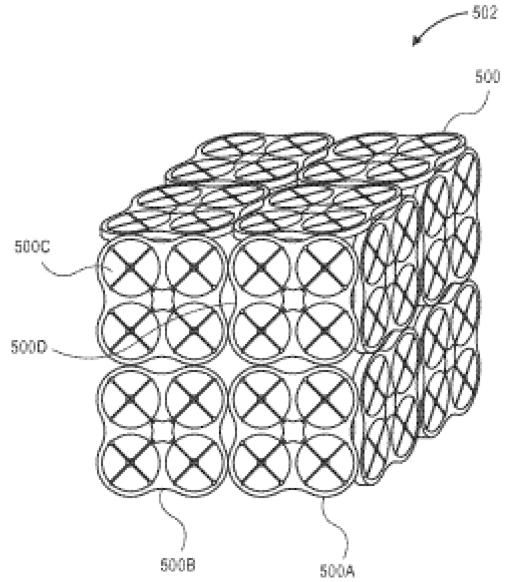


FIG. 5

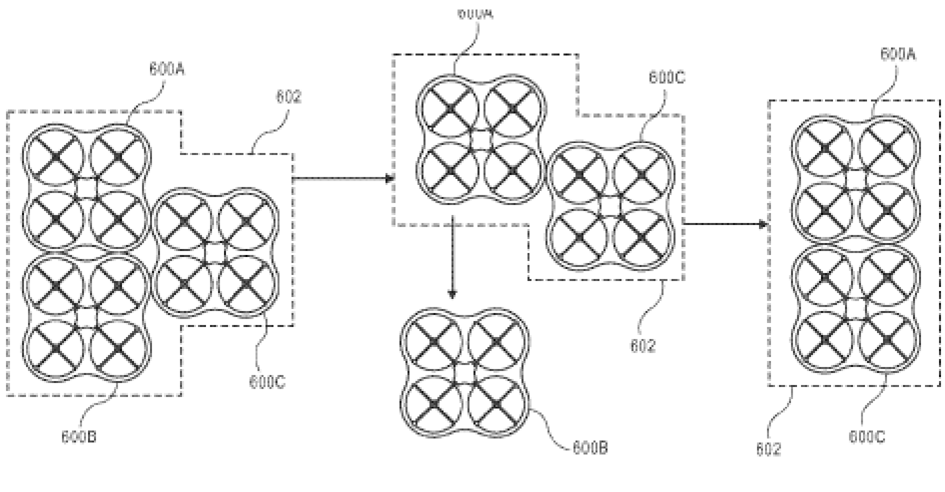


FIG. 6

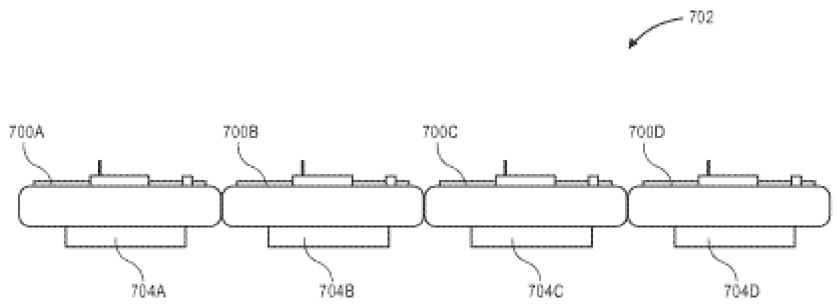


FIG. 7

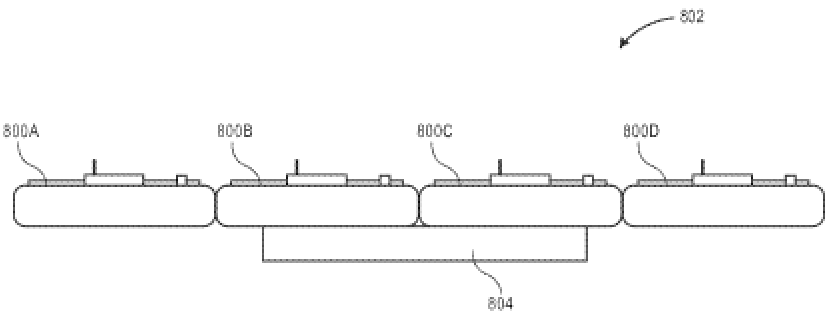


FIG. 8

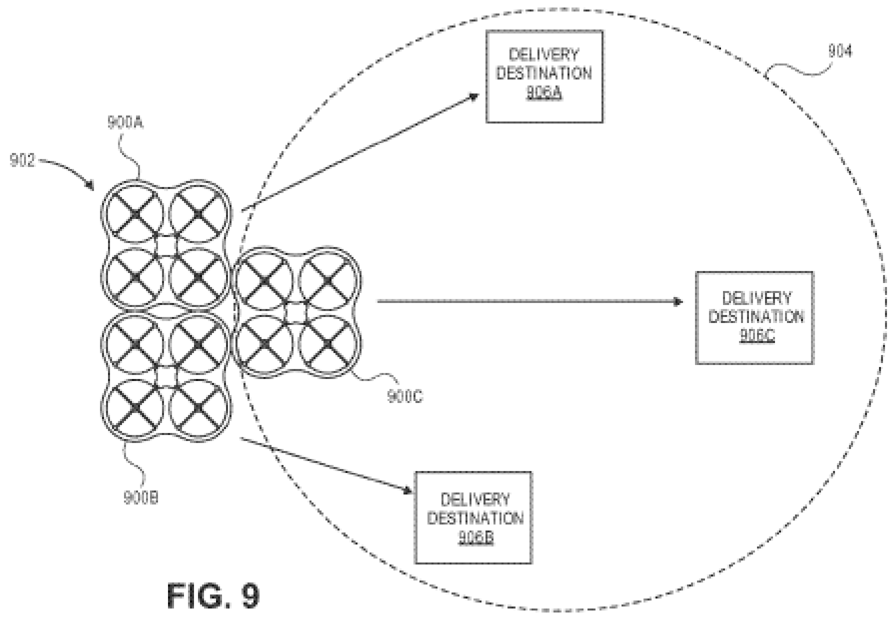


FIG. 9

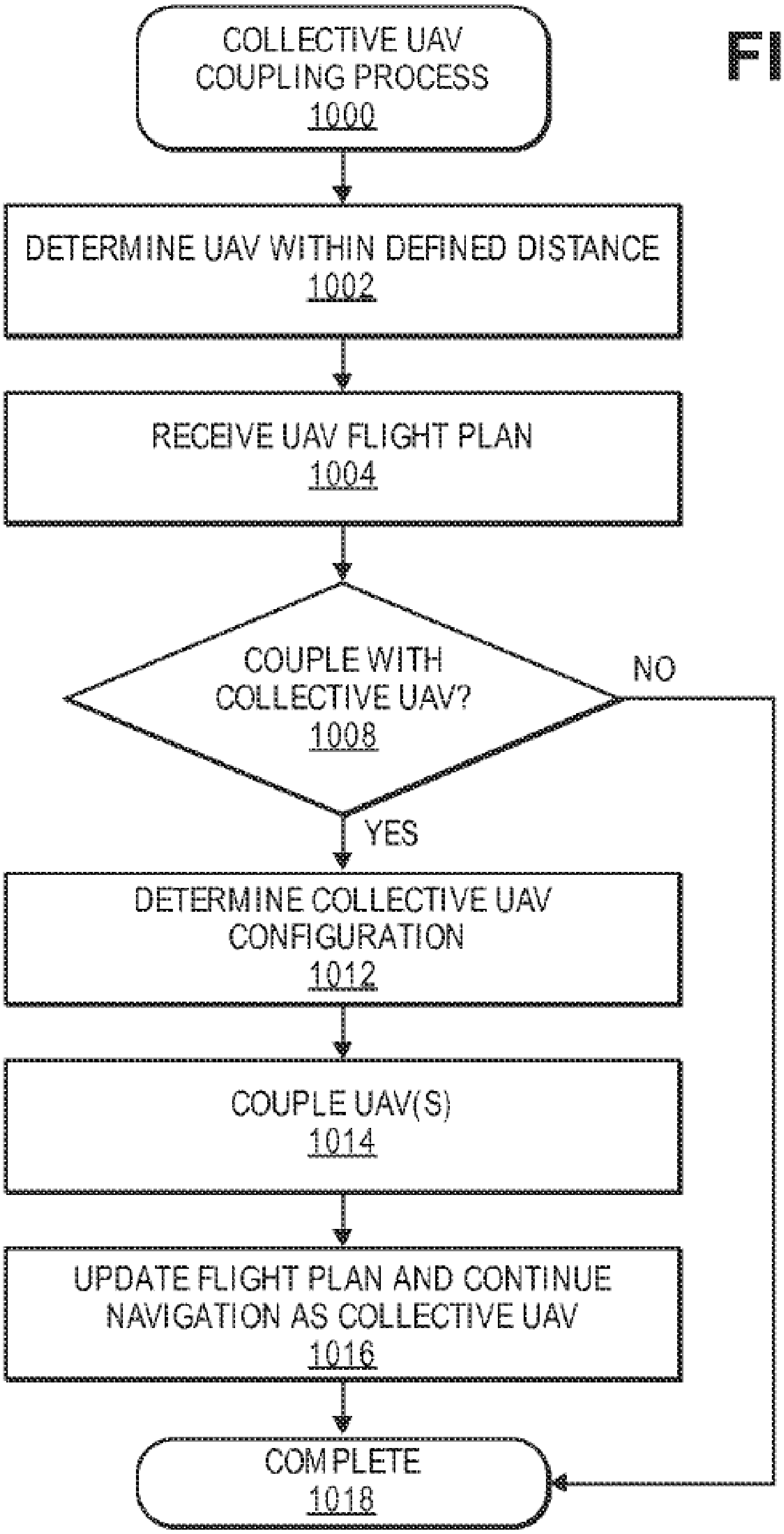

COLLECTIVE UAV COUPLING PROCESS 1000
DETERMINE UAV WITHIN DEFINED DISTANCE 1002
RECEIVE UAV FLIGHT PLAN 1004
COUPLE WITH COLLECTIVE UAV? 1008
NO
YES
DETERMINE COLLECTIVE UAV CONFIGURATION 1012
COUPLE UAV(S) 1014
UPDATE FLIGHT PLAN AND CONTINUE NAVIGATION AS COLLECTIVE UAV 1016
COMPLETE 1018

FIG. 10

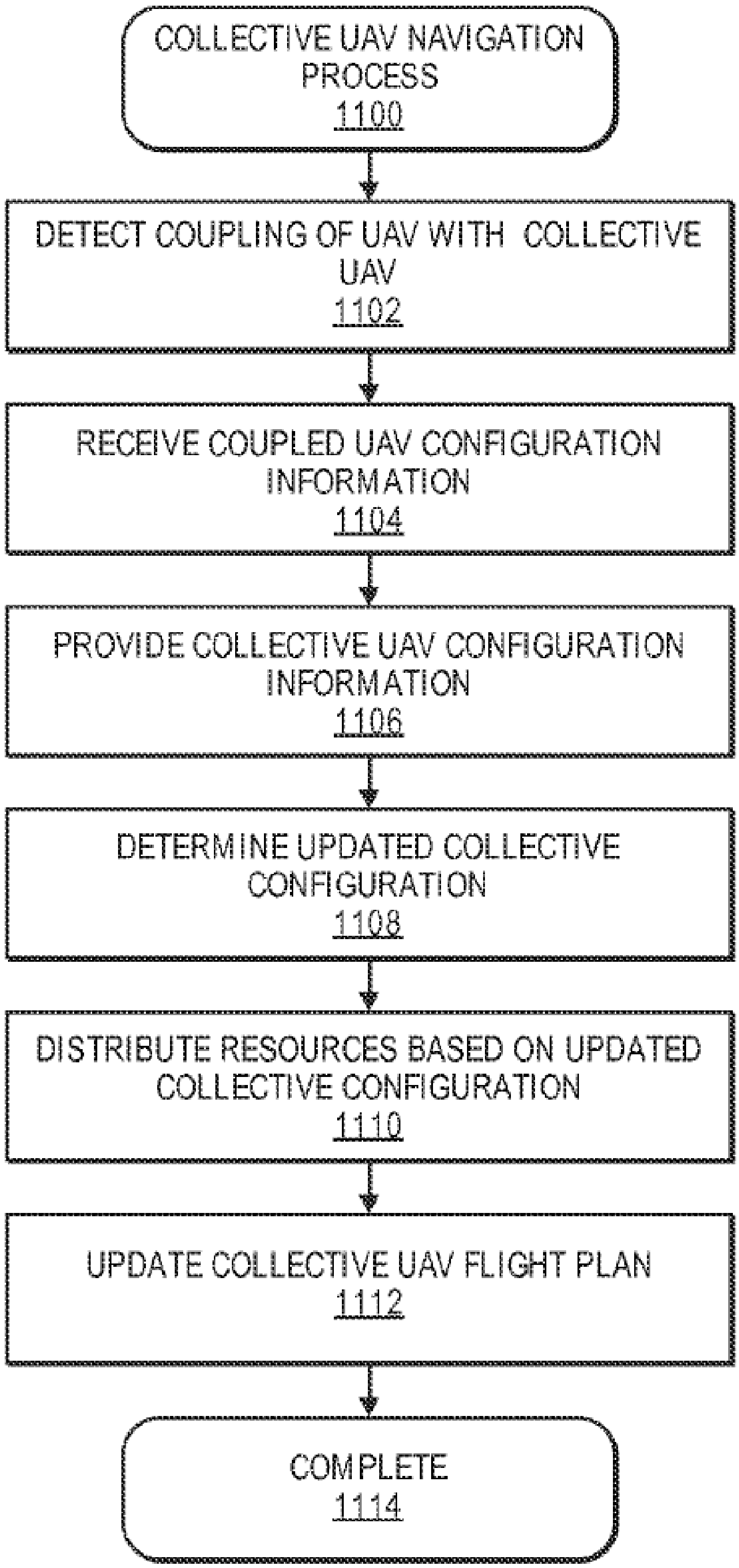

COLLECTIVE UAV NAVIGATION PROCESS
1100
DETECT COUPLING OF UAV WITH COLLECTIVE UAV
1102
RECEIVE COUPLED UAV CONFIGURATION INFORMATION
1104
PROVIDE COLLECTIVE UAV CONFIGURATION INFORMATION
1106
DETERMINE UPDATED COLLECTIVE CONFIGURATION
1108
DISTRIBUTE RESOURCES BASED ON UPDATED COLLECTIVE CONFIGURATION
1110
UPDATE COLLECTIVE UAV FLIGHT PLAN
1112
COMPLETE
1114

FIG. 11

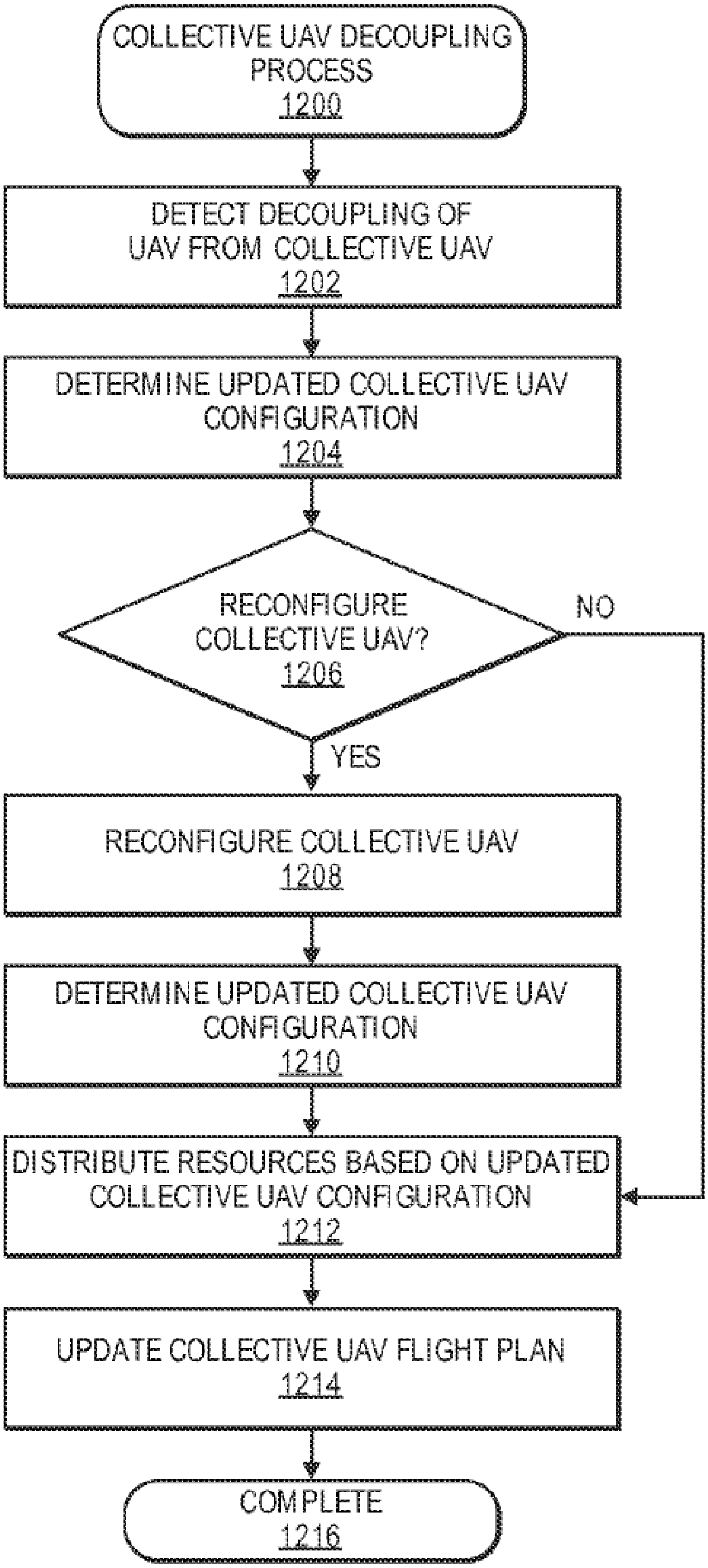

COLLECTIVE UAV DECOUPLING PROCESS
1200
DETECT DECOUPLING OF UAV FROM COLLECTIVE UAV
1202
DETERMINE UPDATED COLLECTIVE UAV CONFIGURATION
1204
RECONFIGURE COLLECTIVE UAV?
1206
NO
YES
RECONFIGURE COLLECTIVE UAV
1208
DETERMINE UPDATED COLLECTIVE UAV CONFIGURATION
1210
DISTRIBUTE RESOURCES BASED ON UPDATED COLLECTIVE UAV CONFIGURATION
1212
UPDATE COLLECTIVE UAV FLIGHT PLAN
1214
COMPLETE
1216

FIG. 12

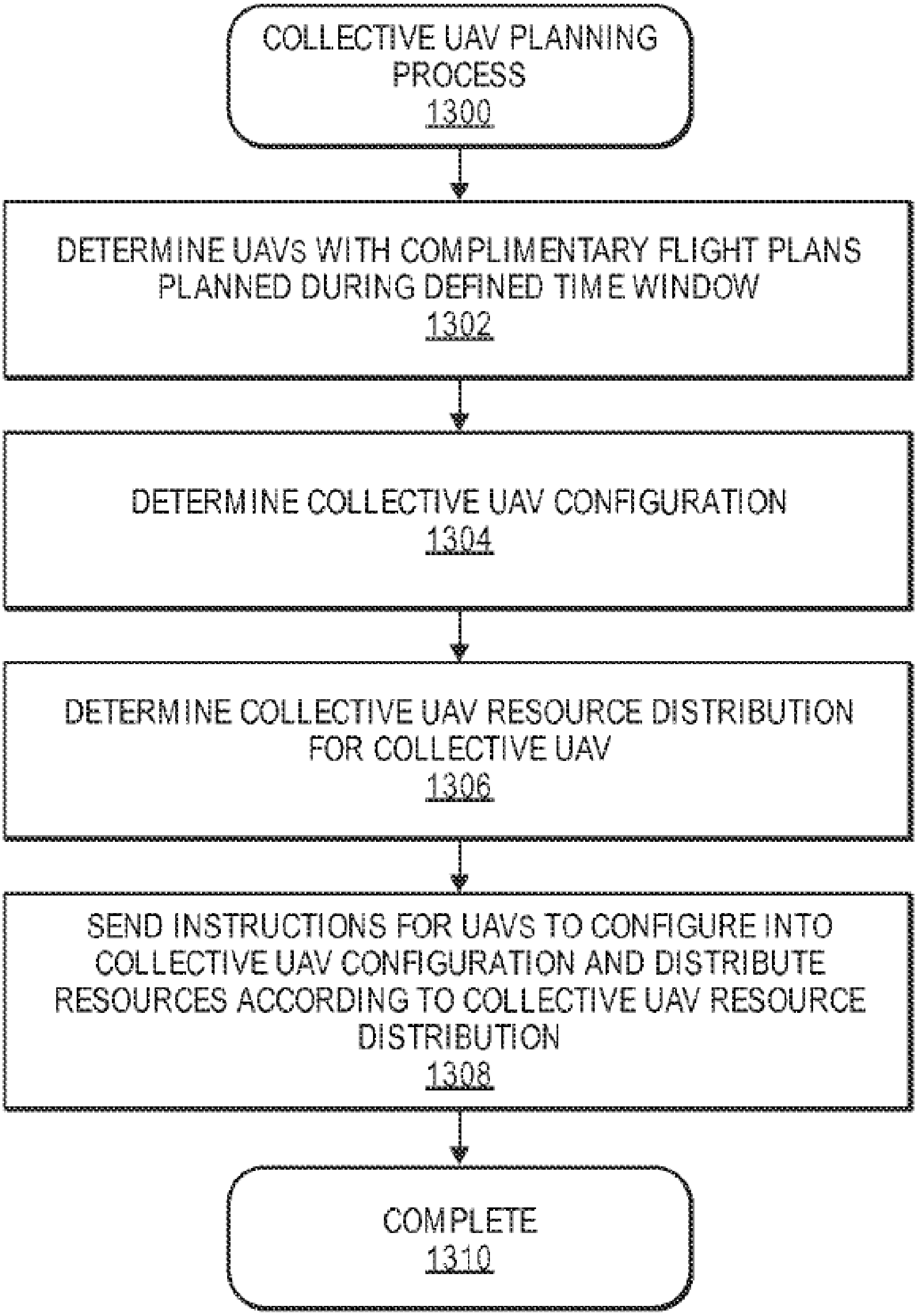

COLLECTIVE UAV PLANNING PROCESS 1300
DETERMINE UAVs WITH COMPLIMENTARY FLIGHT PLANS PLANNED DURING DEFINED TIME WINDOW 1302
DETERMINE COLLECTIVE UAV CONFIGURATION 1304
DETERMINE COLLECTIVE UAV RESOURCE DISTRIBUTION FOR COLLECTIVE UAV 1306
SEND INSTRUCTIONS FOR UAVs TO CONFIGURE INTO COLLECTIVE UAV CONFIGURATION AND DISTRIBUTE RESOURCES ACCORDING TO COLLECTIVE UAV RESOURCE DISTRIBUTION 1308
COMPLETE 1310

FIG. 13

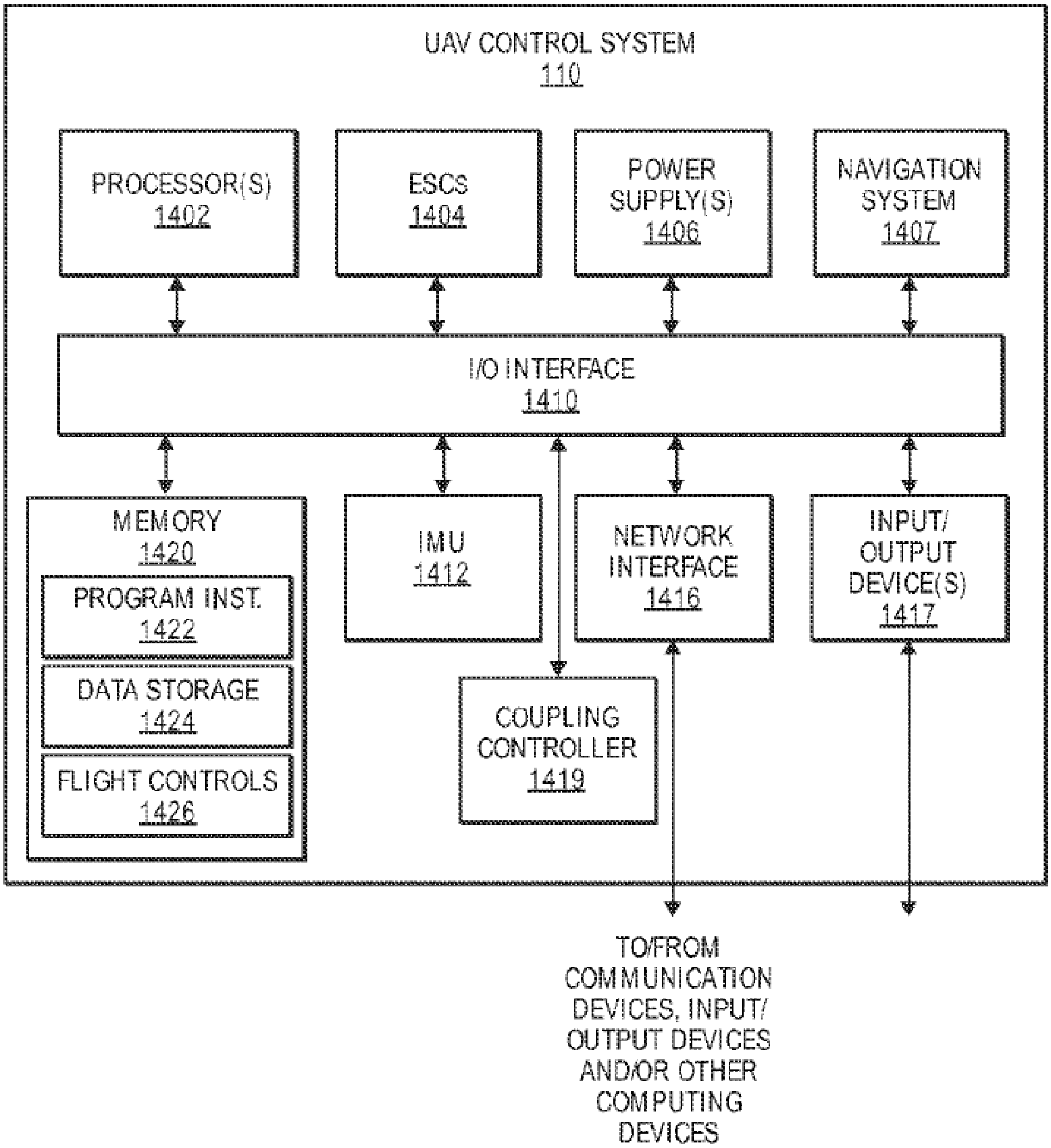
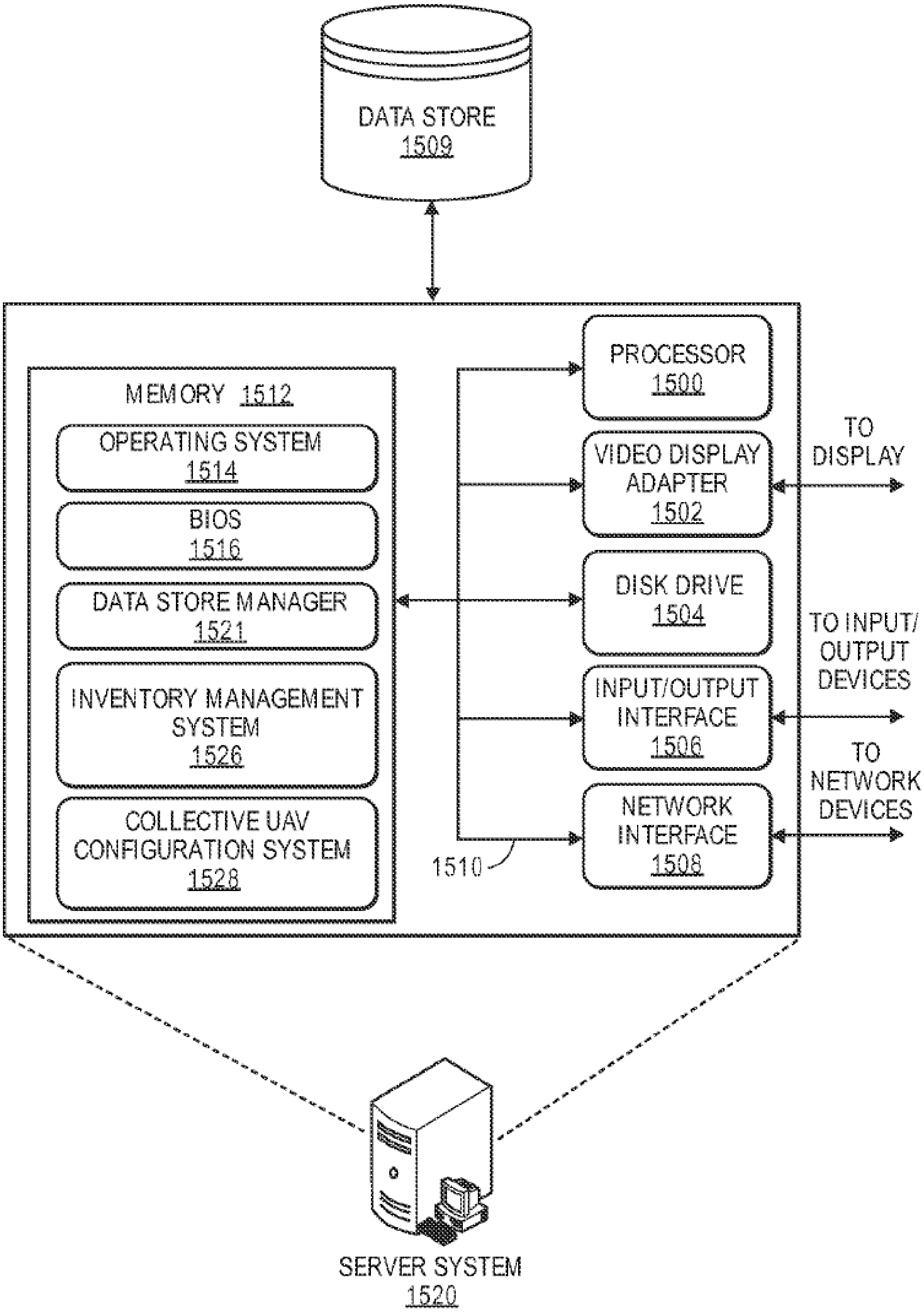

UAV CONTROL SYSTEM
110
PROCESSOR(S)
1402
ESCs
1404
POWER SUPPLY(S)
1406
NAVIGATION SYSTEM
1407
I/O INTERFACE
1410
MEMORY
1420
PROGRAM INST.
1422
DATA STORAGE
1424
FLIGHT CONTROLS
1426
IMU
1412
NETWORK INTERFACE
1416
INPUT/ OUTPUT DEVICE(S)
1417
COUPLING CONTROLLER
1419
TO/FROM COMMUNICATION DEVICES, INPUT/ OUTPUT DEVICES AND/OR OTHER COMPUTING DEVICES

FIG. 14



DATA STORE
1509
MEMORY 1512
OPERATING SYSTEM
1514
BIOS
1516
DATA STORE MANAGER
1521
INVENTORY MANAGEMENT
SYSTEM
1526
COLLECTIVE UAV
CONFIGURATION SYSTEM
1528
PROCESSOR
1500
VIDEO DISPLAY
ADAPTER
1502
TO
DISPLAY
DISK DRIVE
1504
TO INPUT/
OUTPUT
DEVICES
INPUT/OUTPUT
INTERFACE
1506
TO
NETWORK
DEVICES
NETWORK
INTERFACE
1508
1510
SERVER SYSTEM
1520

FIG. 15

FIG. 1 depicts a view of a UAV configuration, according to an implementation.

FIG. 2 depicts a top-down view of a plurality of UAVs forming a collective UAV, according to an implementation.

FIG. 3 depicts a top-down view of a collective UAV configuration, according to an implementation.

FIG. 4 depicts a top-down view of another collective UAV configuration, according to an implementation.
FIG. 5 depicts a view of another collective UAV configuration, according to an implementation.

FIG. 6 depicts a top-down view of a collective UAV configuration with a UAV decoupling from the collective UAV, according to an implementation.

FIG. 7 depicts a side-view of a collective UAV configuration, according to an implementation.

FIG. 8 depicts another side-view of a collective UAV configuration, according to an implementation.

FIG. 9 depicts a top-down view of a collective UAV arriving at a delivery area, according to an implementation.

FIG. 10 is a flow diagram of an example collective UAV coupling process, according to an implementation.

FIG. 11 is a flow diagram of an example collective UAV navigation process, according to an implementation.

FIG. 12 is a flow diagram of a collective UAV decoupling process, according to an implementation.

FIG. 13 is a flow diagram of a collective UAV planning process, according to an implementation.

FIG. 14 is a block diagram of an illustrative implementation of a UAV control system that may be used with various implementations.

FIG. 15 is a block diagram of an illustrative implementation of a server system that may be used with various implementations.

FIG. 1 illustrates a view of a UAV 100, according to an implementation. As illustrated, the UAV 100 includes a frame 104. The frame 104 or body of the UAV 100 may be formed of any suitable material, such as graphite, carbon fiber, aluminium, titanium, etc., or any combination thereof. In this example, the frame 104 of the UAV 100 is a single carbon fiber frame. The frame 104 includes a hub 106, motor arms 108, motor mounts 111, support arms 112, and a perimeter protective barrier 114. In this example, there is a single hub 106, four motor arms 108, four motor mounts 111, twelve support arms 112, and a single perimeter protective barrier 114. In other implementations, a UAV may include additional or fewer hubs, motor arms, motor mounts, support arms, or protective barriers.

Extending from each motor mount 111 are three support arms 112 that couple with or otherwise terminate into the perimeter protective barrier 114. The perimeter protective barrier 114 extends around the perimeter of the UAV and encompasses the lifting propellers 118. In some implementations, the perimeter protective barrier 114 may include a vertical component that extends substantially downward from the support arms and approximately perpendicular to the axis of rotation of the lifting propellers 118. The vertical component may be of any vertical dimension and width. For example, the vertical component may have a vertical dimension of approximately three inches and a width of approximately 0.5 inches. In other implementations, the vertical dimension and/or the width may be larger or smaller. Likewise, the vertical component of the perimeter protective barrier may include a core, such as a foam, wood and/or plastic core. The vertical component may be coupled to each of the support arms and extend around the outer perimeter of each propeller 118 to inhibit access to the propellers from the sides of the UAV 100.

The perimeter protective barrier 114 provides a surface upon which one or more components of the UAV may be mounted. For example, one or more antennas may be mounted to the perimeter protective barrier 114. The antennas may be used to transmit and/or receive wireless communications. For example, the antennas may be utilized for Wi-Fi, satellite, near field communication ("NFC"), cellular communication, or any other form of wireless communication. Other components, such as cameras, time of flight sensors, distance determining elements, gimbals, Global Positioning System ("GPS") receiver/transmitter, radars, illumination elements, speakers, and/or any other component of the UAV 100 or the UAV control system (discussed below), etc., may likewise be mounted to the perimeter protective barrier 114. Likewise, identification or reflective identifiers may be mounted to the vertical component to aid in the identification of the UAV 100.

The coupling components 122 may be on the side, top, or bottom of the perimeter protective barrier 114 to enable coupling of other UAVs at different angles or orientations. For example, the UAV 100 may include a coupling component on a top of the mounting plate 120 so that the UAV 100 may be coupled with a second UAV in a vertical configuration. An example collective UAV configuration with UAVs coupled in different orientations is illustrated in FIG. 5.

In addition to providing a physical coupling between two or more UAVs, the coupling component 122 may provide electrical and/or data communication between coupled UAVs. For example, UAVs may exchange navigation information and/or share computing resources via a data transmission between the coupling components 122 of the coupled UAVs. Likewise, power resources may be shared via the coupling components 122 of the UAVs. For example, the UAV 100 may have excess power supply stored in the power modules. While the UAV 100 is coupled with another UAV, it may provide the excess power supply to the coupled UAV via the connection component 122. A UAV control system 110 is also mounted to the frame 104. In this example, the UAV control system 110 is mounted between the hub 106 and a mounting plate 120. The UAV control system 110, as discussed in further detail below with respect to FIG. 14, controls the operation, routing, navigation, communication, motor controls, resource sharing, coupling components 122, and the payload engagement mechanism of the UAV 100.

FIG. 2 depicts a top-down view of a plurality of UAVs 200 forming a collective UAV 202, according to an implementation. As illustrated in this example, two UAVs 200A, 200B wirelessly communicate to determine if they should couple to form a collective UAV 202. For example, each UAV 200 may exchange flight plan information, configuration information, etc., to determine if forming a collective UAV is beneficial. In one implementation, if the flight plans of each UAV are complementary, it may be determined that the UAVs should couple to form a collective UAV 200. Flight plans may be determined to be complementary if the UAVs 200 are navigating in a similar direction, toward a similar destination (e.g., materials handling facility, delivery area, etc.), coupling would result in a net power savings, coupling would result in increased safety, coupling would result in faster aerial transport, etc. For example, if UAV 200A and UAV 200B are both navigating to the same materials handling facility, it may be determined that their flight plans are complementary. As another example, if UAV 200A is navigating to a first delivery area and UAV 200B is navigating to a second delivery area, it may be determined that the flight plans of the two UAVs 200A, 200B are complementary if UAV 200B will pass the first delivery area within a defined distance as it navigates to the second delivery area.

If it is determined that the two UAVs 200A, 200B are to couple, the UAVs will determine a collective UAV configuration and then couple according to that collective UAV configuration to form a collective UAV 200. The collective UAV configuration may be determined by one or more of the UAVs 200A, 200B, and/or may be determined by a collective UAV configuration system 1528 (FIG. 15) operating on a remote computing resource and provided wirelessly to one or more of the UAVs 200A, 200B. Once coupled, the UAVs 200A, 200B may determine or receive from the collective UAV configuration system 1528 combined operating information and a collective flight plan. For example, if the two UAVs 200A, 200B are navigating to the same materials handling facility, one or more of the UAVs may determine a collective UAV flight plan that is to be followed by each UAV to navigate the collective UAV to the materials handling facility.

A UAV 200C may couple with one or more UAVs that form a collective UAV 202. As illustrated in FIG. 2, the UAV 200C has coupled with both UAV 200A and UAV 200B according to a determined collective UAV configuration. The collective UAV configuration may take any form and may vary depending on, for example, the number of UAVs forming the collective UAV, the weather, the number and/or weight of items carried by UAVs of the collective UAV, power requirements, whether one or more of the UAVs of the collective UAV is damaged or inoperable, etc.

In a cube shape, such as that illustrated in FIG. 5, the collective UAV 502 includes larger surface area on each side of the collective UAV 502 making it more detectable by other aircraft and/or flight control systems. Likewise, the propellers of the UAVs on different sides of the collective UAV 502 may be utilized to adjust the heading, pitch, yaw, and/or roll of the UAV. Still further, one or more of the propellers on a side of the collective UAV 502 may be utilized to provide horizontal thrust to propel the collective UAV in a direction that includes a horizontal component. For example, the propellers of the UAVs 500A, 500B, 500C, and 500D that are coupled to form a side of the collective UAV 502 may be utilized to provide horizontal thrust for the collective UAV 502. Likewise, the propellers on the top and/or bottom of the collective UAV 502 may provide lifting force to lift the collective UAV 502.

FIG. 6 depicts a top-down view of a collective UAV 602 with a UAV 600B decoupling from the collective UAV, according to an implementation. In this example, the collective UAV 602 includes three coupled UAVs 600A, 600B, 600C that are aerially navigating along a flight path. At some point during aerial navigation, UAV 600B decouples from the collective UAV 602. For example, UAV 600B may have reached a point in the flight path where it is to decouple from the collective UAV and navigate to another location (e.g., delivery destination). Upon decoupling from the collective UAV 602, the UAV 600B may resume aerial navigation utilizing its own UAV control system to aerially navigate to a destination. Likewise, when a UAV decouples from a collective UAV 602, the collective UAV 602 determines the updated collective UAV configuration and/or whether the remaining UAVs 600A, 600C of the collective UAV 602 should reconfigure into a different configuration. For example, upon decoupling of UAV 600B, the remaining UAVs 600A, 600C are coupled with one coupling component and offset from one-another. Because this may not be a preferred UAV configuration, it may be determined that the UAVs 600A, 600C should decouple and then recouple to form a different UAV configuration, as illustrated. In other implementations, the UAVs may remain in the existing configuration.

FIG. 8 depicts another side-view of a collective UAV 802 configuration, according to an implementation. In this example, two of the UAVs 800B, 800C are coupled to a single payload 804 and two other UAVs 800A, 800D are coupled to UAVs 800B, 800C, but do not have any coupled payloads. In this example, the payload 804 is heavier than a single UAV can aerially transport, so two UAVs 800B, 800C are coupled to form a collective UAV that is coupled to the payload 804 to enable aerial transport of the payload 804. Likewise, the delivery destination is beyond the range that two coupled UAVs 800B, 800C can reach under their own power so two additional UAVs 800A, 800D are coupled with the UAVs 800B, 800C to form the collective UAV 802 to enable aerial transport of the payload 804. In such an example, the collective UAV may aerially navigate the payload to a delivery area. When the collective UAV 802 reaches the delivery area, the two UAVs 800B, 800C may decouple from the other two UAVs 800A, 800D to complete delivery of the payload 804 to a delivery destination. After the payload is delivered, the two UAVs 800B, 800C may recouple with the two UAVs 800A, 800D to aerially navigate together to another location.

Decoupling one or more of the UAVs from the collective UAV to complete delivery of the item improves the safety around the delivery destination and increases the agility of the UAV or collective UAV as it delivers the item to the delivery destination. For example, if there are numerous UAVs coupled to form a collective UAV, the collective UAV may be several feet wide. For example, referring again to FIG. 4, if each UAV 400 is approximately two feet wide by approximately two feet long, the collective UAV 402 will be approximately ten feet wide by approximately eight feet long. As another example, referring to FIG. 5, if each UAV 500 is approximately two feet wide by approximately two feet long, the collective UAV 502 will be approximately four feet wide by approximately four feet long by approximately four feet tall.

FIG. 9 depicts a top-down view of a collective UAV 902 arriving at a delivery area 904, according to an implementation. As the collective UAV 902 arrives at the delivery area 904, the UAVs 900A, 900B, 900C may decouple and complete delivery of payload carried by the UAV to a delivery destination 906. For example, UAV 900A may decouple from the collective UAV 902 and complete delivery of a payload to delivery destination 906A. UAV 900B may decouple from the collective UAV 902 and complete delivery of a payload to delivery destination 906B. Likewise, UAV 900C may decouple from the collective UAV and complete delivery of a payload to delivery destination 906C.

FIG. 10 is a flow diagram of an example collective UAV coupling process 1000, according to an implementation. This process, and each process described herein, may be implemented by the architectures described herein or by other architectures. The process is illustrated as a collection of blocks in a logical flow graph. Some of the blocks represent operations that can be implemented in hardware, software, or a combination thereof. In the context of software, the blocks represent computer-executable instructions stored on one or more computer readable media that, when executed by one or more processors, perform the recited operations. Generally, computer-executable instructions include routines, programs, objects, components, data structures, and the like that perform particular functions or implement particular abstract data types.

The computer readable media may include non-transitory computer readable storage media, which may include hard drives, floppy diskettes, optical disks, CD-ROMs, DVDs, read-only memories (ROMs), random access memories (RAMs), EPROMs, EEPROMs, flash memory, magnetic or optical cards, solid-state memory devices, or other types of storage media suitable for storing electronic instructions. In addition, in some implementations, the computer readable media may include a transitory computer readable signal (in compressed or uncompressed form). Examples of computer readable signals, whether modulated using a carrier or not, include, but are not limited to, signals that a computer system hosting or running a computer program can be configured to access, including signals downloaded through the Internet or other networks. Finally, the order in which the operations are described is not intended to be construed as a limitation, and any number of the described operations can be combined in any order and/or in parallel to implement the process.

Based on the flight plans, a determination is made as to whether the flight plans of the two UAVs are complementary and whether the two UAVs should be coupled to form a collective UAV, as in 1008. For example, if both flight plans are similar, in a similar direction, toward a similar destination (e.g., delivery area, materials handling facility), it may be determined that the flight plans of the two UAVs are complementary.
Upon determining the collective UAV configuration, the first UAV and the second UAV couple to form a collective UAV according to the determined collective UAV configuration, as in 1014. The flight plans are also updated or a single flight plan for the collective UAV is determined based on the destinations of each UAV, as in 1016. For example, if the two UAVs are navigating to different destinations that are separated by a distance, a collective UAV flight plan may be determined that causes that collective UAV to aerially navigate to a point between the two destinations before the two UAVs decouple and complete navigation independently to the respective destinations. In some implementations, the point between the destinations may be a midpoint. In other implementations, the point between the destinations may be determined based on the location of the destinations, the power and navigation capabilities of the UAVs, the delivery time for the UAVs, etc. For example, a first UAV may have more power remaining than a second UAV so the flight plan may instruct the collective UAV to navigate toward the destination of the first UAV and for the second UAV to decouple at a point along the flight plan to complete navigation to the destination of the second UAV.

FIG. 11 is a flow diagram of an example collective UAV navigation process 1100, according to an implementation. The example process 1100 begins by detecting a coupling of a UAV with the collective UAV, as in 1102. As discussed above with respect to FIG. 10, a UAV may be instructed to couple with the collective UAV according to a collective UAV configuration. Once the UAV couples with the collective UAV, the coupling is detected by at least one other UAV of the collective UAV. For example, a first UAV of the collective UAV to which a second UAV couples may determine that the second UAV has coupled with the collective UAV. Upon coupling, the UAV configuration information of the coupled UAV is received from the coupled UAV, as in 1104. The UAV configuration information may include a UAV identifier, navigation information, power supply capabilities, motor and propeller configuration, weight of the UAV and/or payload, the location of the UAV's sensors, etc. In addition to receiving UAV configuration information from the coupled UAV, the collective UAV configuration information may be provided to the coupled UAV, as in 1106. The collective UAV configuration information may identify, for example, the navigation information of the collective UAV, operating parameters, the configuration of the collective UAV, the sensor locations of sensors that are being used by the collective UAV, etc.

FIG. 12 is a flow diagram of a collective UAV decoupling process 1200, according to an implementation. The example process 1200 begins when a decoupling of a UAV from the collective UAV is determined, as in 1202. As discussed above with respect to FIGS. 6 and 9, a UAV may decouple from the collective UAV to, for example, complete delivery of a payload to a delivery destination. Once the UAV decouples from the collective UAV, the decoupling is detected by at least one other UAV of the collective UAV. For example, a first UAV of the collective UAV from which a second UAV decoupled may determine that the second UAV has decoupled from the collective UAV. Likewise, the second UAV may provide a notification that it is decoupling from the collective UAV.

FIG. 13 is a flow diagram of an example collective UAV planning process 1300, according to an implementation. The example collective UAV planning process 1300 may be performed by the collective UAV configuration system 1528. For example, the collective UAV configuration system 1528 may perform that collective UAV planning process while items are being packaged for delivery at a materials handling facility to determine a collective UAV that will aerially navigate from the materials handling facility to a delivery area.

FIG. 14 is a block diagram illustrating an example UAV control system 110. In various examples, the block diagram may be illustrative of one or more aspects of the UAV control system 110 that may be used to implement the various systems and methods discussed herein and/or to control operation of the UAVs described herein. In the illustrated implementation, the UAV control system 110 includes one or more processors 1402, coupled to a memory, e.g., a non-transitory computer readable storage medium 1420, via an input/output (I/O) interface 1410. The UAV control system 110 may also include electronic speed controls 1404 (ESCs), power supply modules 1406, a navigation system 1407, and/or an inertial measurement unit (IMU) 1412. In some implementations, the IMU may be incorporated into the navigation system 1407. The UAV control system 110 may also include a coupling controller 1419 configured to control the coupling component(s) that is used to couple/decouple the UAV from other UAVs. The UAV control system 110 may also include a payload engagement controller (not shown), a network interface 1416, and one or more input/output devices 1417.

Input/output devices 1417 may, in some implementations, include one or more displays, imaging devices, thermal sensors, infrared sensors, time of flight sensors, accelerometers, pressure sensors, weather sensors, cameras, gimbals, landing gear, etc. Multiple input/output devices 1417 may be present and controlled by the UAV control system 110. One or more of these sensors may be utilized to assist in landing as well as to avoid obstacles during flight.

FIG. 15 is a pictorial diagram of an illustrative implementation of a server system 1520 that may be used in the implementations described herein. The server system 1520 may include a processor 1500, such as one or more redundant processors, a video display adapter 1502, a disk drive 1504, an input/output interface 1506, a network interface 1508, and a memory 1512. The processor 1500, the video display adapter 1502, the disk drive 1504, the input/output interface 1506, the network interface 1508, and/or the memory 1512 may be communicatively coupled to each other by a communication bus 1510.

The data store 1509 can include several separate data tables, databases or other data storage mechanisms and media for storing data relating to a particular aspect. [0103] The memory 1512 may also include the collective UAV configuration system 1528, discussed above. The collective UAV configuration system 1528 may be executable by the processor 1500 to implement one or more of the functions of the server system 1520. In one implementation, the collective UAV configuration system 1528 may represent instructions embodied in one or more software programs stored in the memory 1512.

[0104] The server system 1520, in one implementation, is a distributed environment utilizing several computer systems and components that are interconnected via communication links, using one or more computer networks or direct connections. However, it will be appreciated by those of ordinary skill in the art that such a system could operate equally well in a system having fewer or a greater number of components than are illustrated in FIG. 15. Thus, the depiction in FIG. 15 should be taken as being illustrative in nature and not limiting to the scope of the disclosure.