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(54) **MOBILE AGRICULTURAL HOLDING MANAGEMENT**

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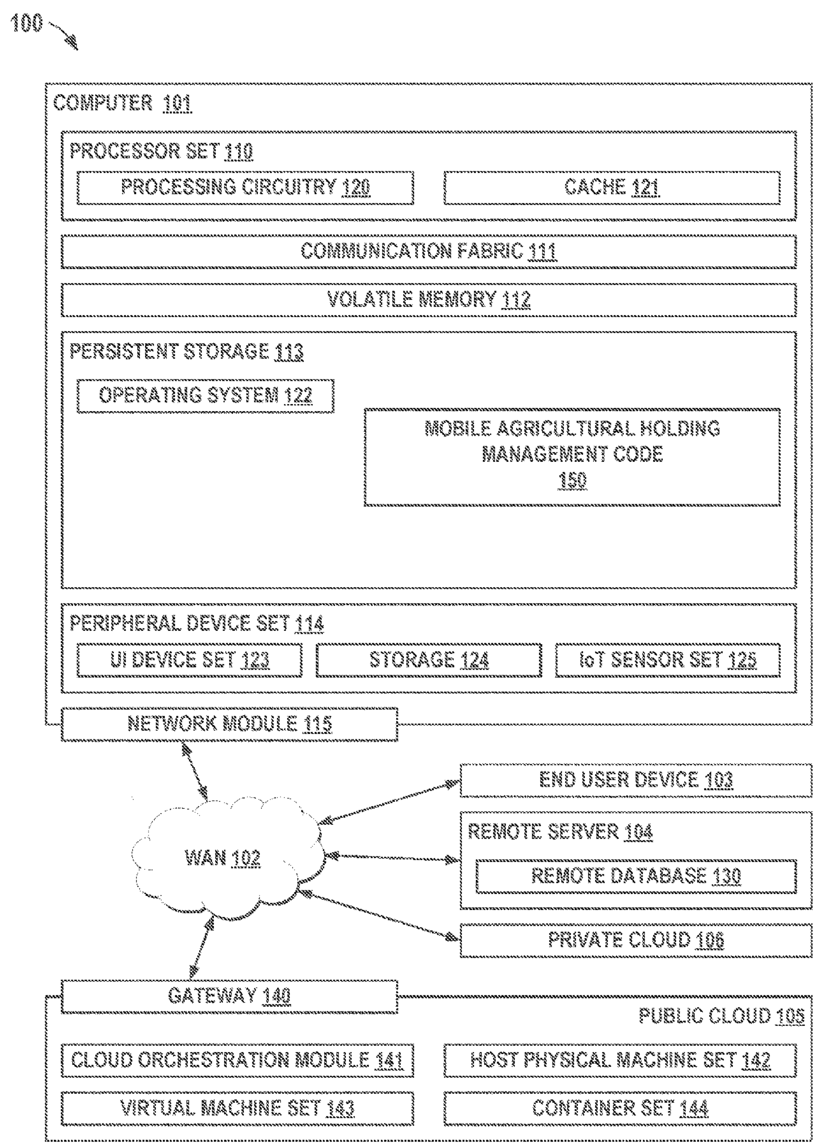
(57) **ABSTRACT**

Aspects of the present disclosure relate to mobile agricultural holding management. Crop data associated with a mobile agricultural holding can be received. Weather data associated with the mobile agricultural holding can be received. The crop data and the weather data can be analyzed to determine whether a rule is satisfied for reconfiguring the mobile agricultural holding. In response to determining that the rule is satisfied for reconfiguring the mobile agricultural holding, a control signal can be issued to at least one processing circuit of the mobile agricultural holding to execute a reconfiguration action.



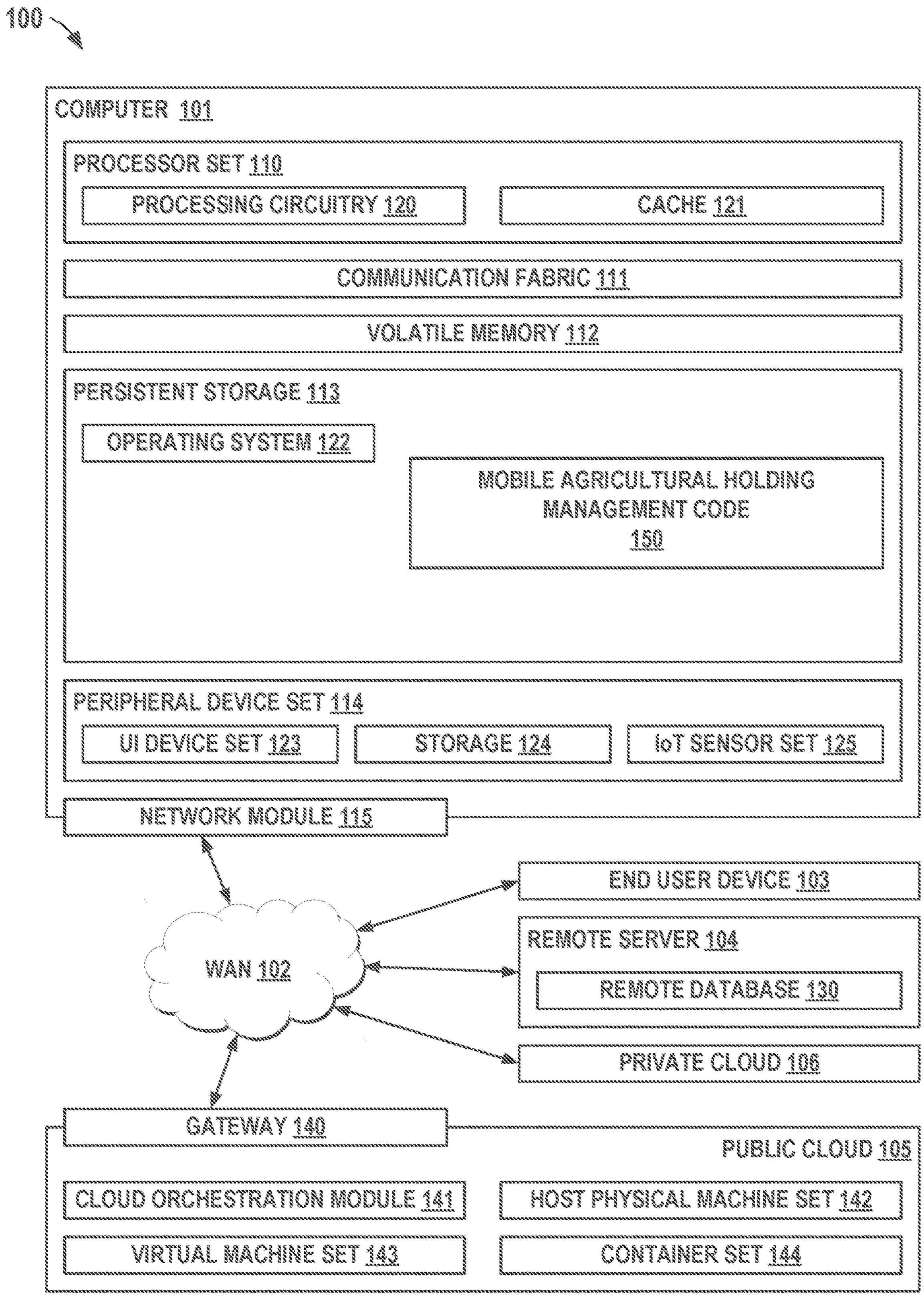

100
COMPUTER 101
PROCESSOR SET 110
PROCESSING CIRCUITRY 120
CACHE 121
COMMUNICATION FABRIC 111
VOLATILE MEMORY 112
PERSISTENT STORAGE 113
OPERATING SYSTEM 122
MOBILE AGRICULTURAL HOLDING MANAGEMENT CODE 150
PERIPHERAL DEVICE SET 114
UI DEVICE SET 123
STORAGE 124
IoT SENSOR SET 125
NETWORK MODULE 115
END USER DEVICE 103
REMOTE SERVER 104
REMOTE DATABASE 130
WAN 102
PRIVATE CLOUD 106
GATEWAY 140
PUBLIC CLOUD 105
CLOUD ORCHESTRATION MODULE 141
HOST PHYSICAL MACHINE SET 142
VIRTUAL MACHINE SET 143
CONTAINER SET 144

FIG. 1

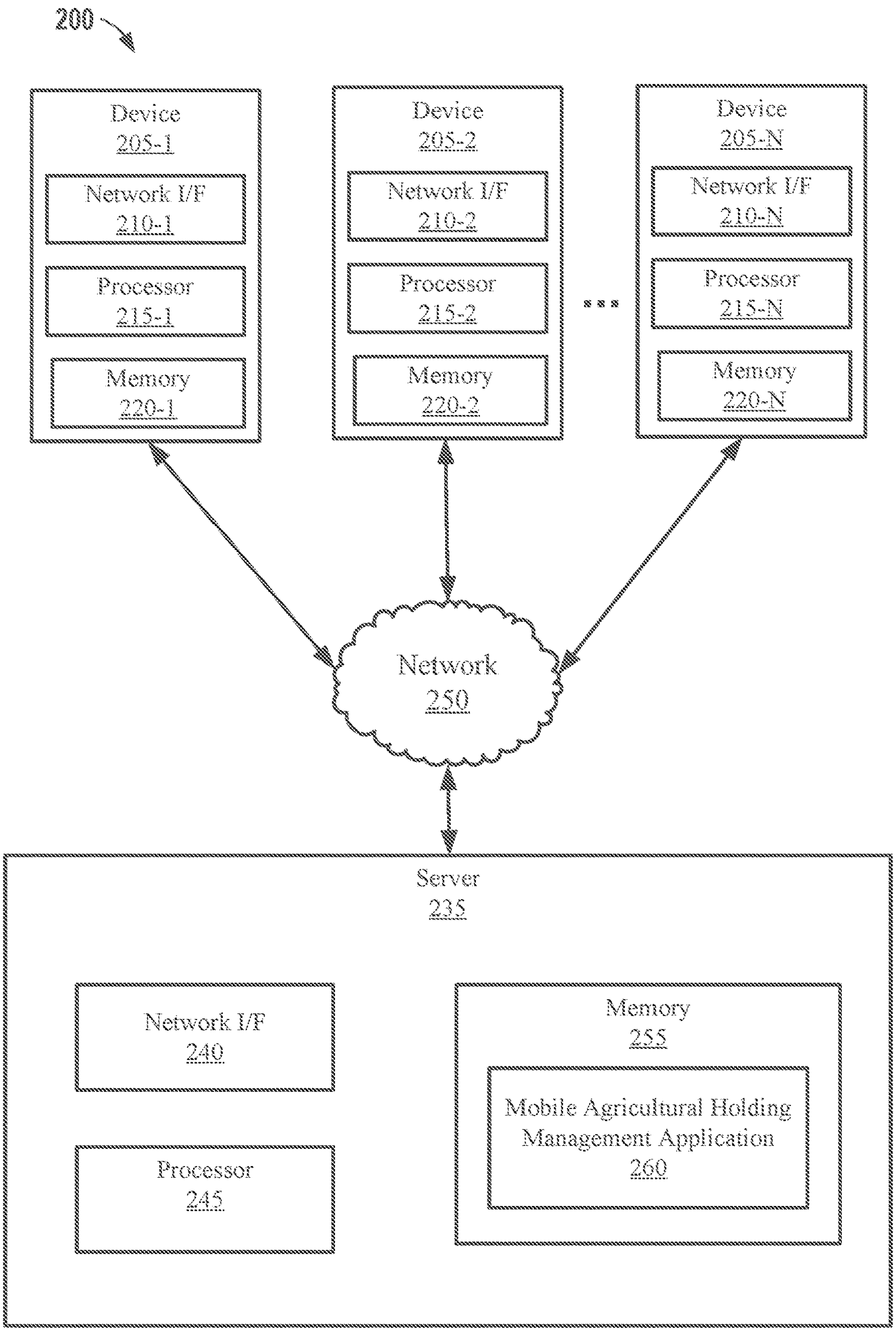

200
Device
205-1
Network I/F
210-1
Processor
215-1
Memory
220-1
Device
205-2
Network I/F
210-2
Processor
215-2
Memory
220-2
Device
205-N
Network I/F
210-N
Processor
215-N
Memory
220-N
Network
250
Server
235
Network I/F
240
Processor
245
Memory
255
Mobile Agricultural Holding
Management Application
260

FIG. 2

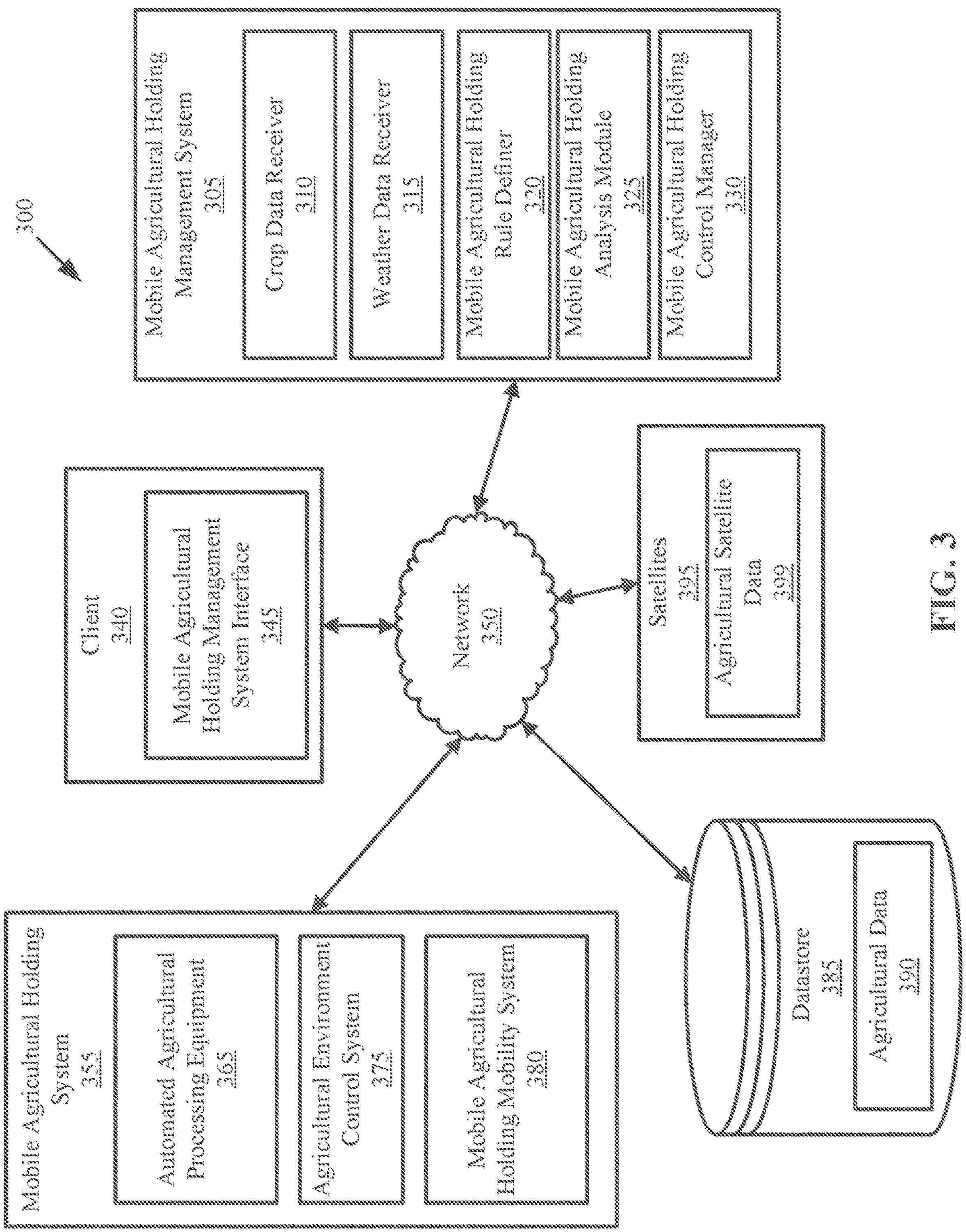

300
Mobile Agricultural Holding Management System 305
Crop Data Receiver 310
Weather Data Receiver 315
Mobile Agricultural Holding Rule Definer 320
Mobile Agricultural Holding Analysis Module 325
Mobile Agricultural Holding Control Manager 330
Client 340
Mobile Agricultural Holding Management System Interface 345
Network 350
Satellites 395
Agricultural Satellite Data 399
Mobile Agricultural Holding System 355
Automated Agricultural Processing Equipment 365
Agricultural Environment Control System 375
Mobile Agricultural Holding Mobility System 380
Datastore 385
Agricultural Data 390

FIG. 3

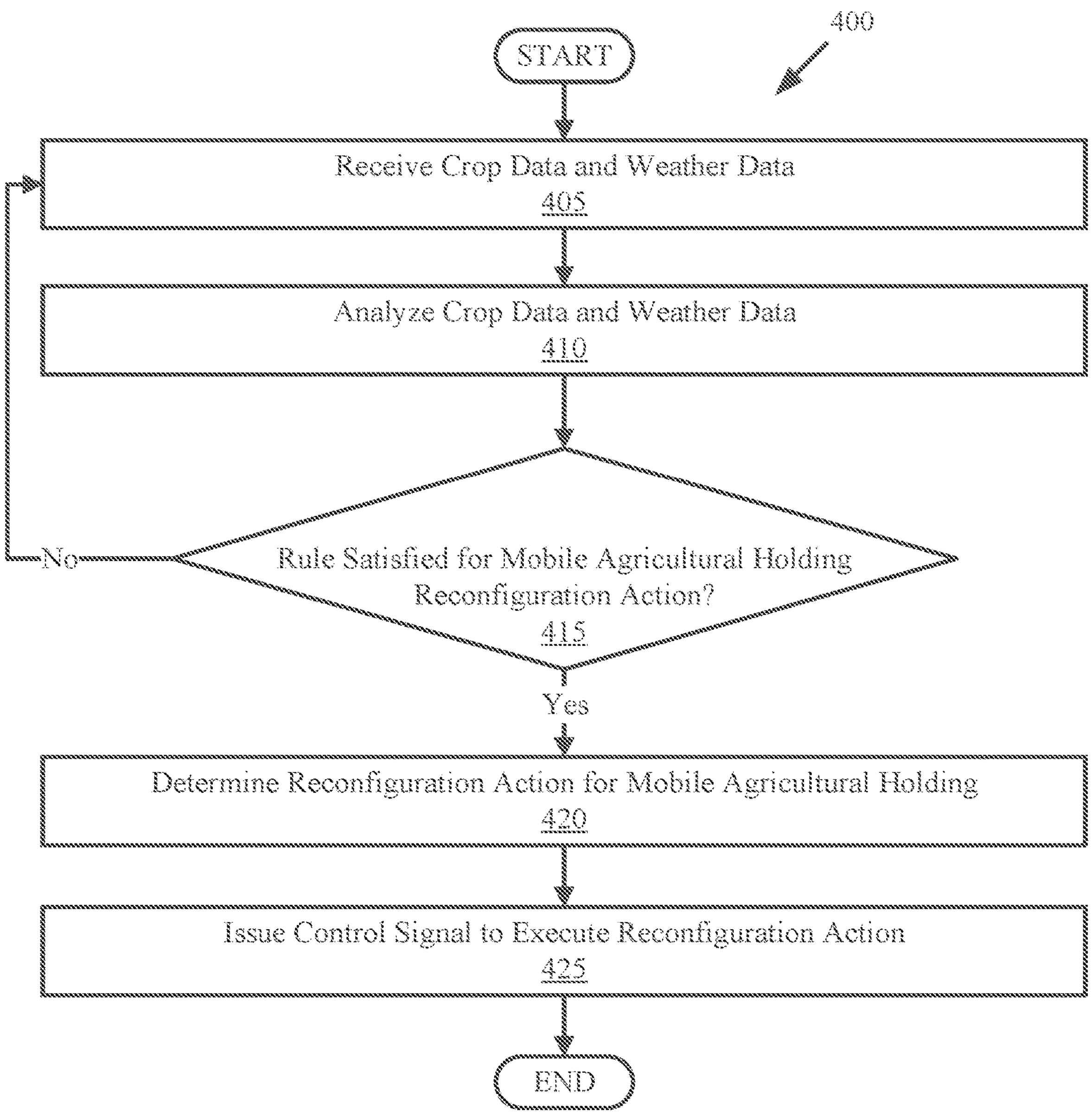

400
START
Receive Crop Data and Weather Data
405
Analyze Crop Data and Weather Data
410
No
Rule Satisfied for Mobile Agricultural Holding Reconfiguration Action?
415
Yes
Determine Reconfiguration Action for Mobile Agricultural Holding
420
Issue Control Signal to Execute Reconfiguration Action
425
END

FIG. 4

500

2.5	3.9	2.7	0.0	0.0
4.0	1.0	1.9	4.4	0.0
0.6	2.6	2.2	6.2	0.0
c	0.0	0.0	3.2	5.1
0.0	1.4	0.0	1.9	6.3 j

J – cost/reward function (energy gain)
u_j - Binary decision variable (optimal spatial pixel 'j')
T_j, P_j, H_j - available temperature, precipitation and humidity for the spatial pixel 'j' for the forecasted time horizon
T_c^*, P_c^*, H_c^* - temperature, precipitation and humidity at the current location 'c' for the forecasted time horizon
E_T - Energy lost (water jet + anchor retrieval) in moving the floating farm
Dist(j,c) – distance between the pixel 'j' and the current location 'c'
Speed(j,c)- speed between the pixel 'j' and the current location 'c'
time (j,c)- travel time between the pixel 'j' and the current location 'c'
w_L, w_D, w_{temp} - weighing coefficient for light harvest by floating farm and energy lost in moving respectively
$j(x,y)$ – pixel 'j' with x and y co-ordinates
$D^{max}, t^{max}, speed^{max}, j(x,y)^{max}$ - Maximum limit for distance, time, speed and co-ordinates respectively
$f_{j,c}$ - factor to account for heavy tides/currents (1 – when going towards currents & ~1.05 for against the currents)

$$J = Max\,.\sum_{\substack{j=1,\\ t}}^{N} u_{j,t}\,\{\underbrace{w_L Y\left(T_j - T_c^*, P_j - P_c^*, H_j - H_c^*\right)}_{\text{Increase in crop yield by repositioning}} - \underbrace{w_D\,.E_T\left(Dist(j,c), speed(j,c), f_{j,c}\right)\}}_{\text{Energy lost in repositioning}}$$

$$+\underbrace{y_t\,\{w_Y Y\left(T_j - T_l^*, P_j - P_l^*, H_j - H_l^*\right)\big)}_{\text{Increase in crop yield by environmental control}} - \underbrace{w_{LW}\,.E_{LW}(T_l^*, P_l^*, H_l^*)\}}_{\text{Energy lost from environmental control}}$$

subject to $\sum_{i=1}^{N} u_{j,t} + y_t \leq 1$ $\quad 0 \leq time(j,c) \leq t^{max}$; $\quad j(x,y)^{min} \leq j(x,y) \leq j(x,y)^{max}$;

$0 \leq Dist(j,c) \leq D^{max}$; $\quad 0 \leq speed(j,c) \leq speed^{max}$; $\quad time(j,c)\ \alpha\ (Dist(j,c)\ /\ speed(j,c))$;

FIG. 5

MOBILE AGRICULTURAL HOLDING MANAGEMENT

BACKGROUND

[0001] An agricultural holding, commonly referred to as a farm, is an area of land devoted to producing food and other crops. Farming started as humans transitioned from hunter-gatherer settlements to larger agricultural societies. As technological advancements have been made, farming has become more widespread and efficient. For example, farming has become automated through the use of satellite guided farming, heavy machinery, automated equipment, and unmanned air-vehicles. More recently, mobile agricultural holdings (e.g., floating farms) have been developed, which enable an agricultural holding to be repositioned.

SUMMARY

[0002] Aspects of the present disclosure relate to a computer program product, system, and method for mobile agricultural holding management.

[0003] Crop data associated with a mobile agricultural holding can be received. Weather data associated with the mobile agricultural holding can be received. The crop data and the weather data can be analyzed to determine whether a rule is satisfied for reconfiguring the mobile agricultural holding. In response to determining that the rule is satisfied for reconfiguring the mobile agricultural holding, a control signal can be issued to at least one processing circuit of the mobile agricultural holding to execute a reconfiguration action.

[0004] The above summary is not intended to describe each illustrated embodiment or every implementation of the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] The drawings included in the present disclosure are incorporated into, and form part of, the specification. They illustrate embodiments of the present disclosure and, along with the description, serve to explain the principles of the disclosure. The drawings are only illustrative of typical embodiments and do not limit the disclosure.

[0006] FIG. **1** is a high-level block diagram illustrating an example computer system and network environment that can be used in implementing one or more of the methods, tools, modules, and any related functions described herein, in accordance with embodiments of the present disclosure.

[0007] FIG. **2** is block diagram illustrating an example network environment, in accordance with embodiments of the present disclosure.

[0008] FIG. **3** is a block diagram illustrating an example network environment including a mobile agricultural holding management system, in accordance with embodiments of the present disclosure.

[0009] FIG. **4** is a flowchart illustrating an example method for mobile agricultural holding management, in accordance with embodiments of the present disclosure.

[0010] FIG. **5** is a diagram depicting a cost/reward function that can be implemented for managing a mobile agricultural holding, in accordance with embodiments of the present disclosure.

[0011] While the embodiments described herein are amenable to various modifications and alternative forms, specifics thereof have been shown by way of example in the drawings and will be described in detail. It should be understood, however, that the particular embodiments described are not to be taken in a limiting sense. On the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the disclosure.

DETAILED DESCRIPTION

[0012] Aspects of the present disclosure relate generally to the field of computing, and more particularly, to mobile agricultural holding management. While the present disclosure is not necessarily limited to such applications, various aspects of the disclosure may be appreciated through a discussion of various examples using this context.

[0013] As discussed above, farming has become automated through the use of satellite guided farming, heavy machinery, automated equipment, and unmanned air-vehicles. Mobile agricultural holdings have recently been developed, which enables an agricultural holding to be repositioned. For example, floating farms have been implemented in which a vessel (e.g., a ship) is dedicated as farm space, allowing farmers to reposition their farm via movement on water. Thus, favorable weather for growing crops becomes a controllable variable within mobile agricultural holdings.

[0014] Though there are significant benefits to mobile agricultural holdings, there are various risks and costs. Repositioning a mobile agricultural holding can be expensive. Due to the large mass of a mobile agricultural holding, fuel cost can become a significant factor associated with operating cost. Mobile agricultural holdings also require maintenance depending on the type of transportation mechanism. For example, a floating farm may require the same maintenance as operating a large ship (e.g., a cargo ship). This includes maintenance measures to minimize environmental impact on the vessel, proper waste management, resource management, and adherence to environmental standards (e.g., emission control regulations and environmentally friendly materials/technologies).

[0015] Further, pests and disease continue to remain an issue for growing crops on a mobile agricultural holding. However, in the case of mobile agricultural holdings, access to infrastructure can be limited due to the remote locations of the mobile agricultural holdings. Thus, the cost for monitoring and treating pests/disease in mobile agricultural holdings can be relatively more expensive than a traditional farm. Further still, weather and marine conditions can directly impact crop production and safety within mobile agricultural holdings. Thus, aspects of the present disclosure recognize the various tradeoffs associated with properly managing a mobile agricultural holding.

[0016] Aspects of the present disclosure relate to mobile agricultural holding management. Crop data associated with a mobile agricultural holding can be received. Weather data associated with the mobile agricultural holding can be received. The crop data and the weather data can be analyzed to determine whether a rule is satisfied for reconfiguring the mobile agricultural holding. In response to determining that the rule is satisfied for reconfiguring the mobile agricultural holding, a control signal can be issued to at least one processing circuit of the mobile agricultural holding to execute a reconfiguration action.

[0017] Aspects of the present disclosure provide various benefits. By analyzing historical, real-time, and projected crop and weather data, a set of rules dictating management of a mobile agricultural holding can be complied with. In particular, the specific requirements for growing crops on a mobile agricultural holding can be followed, thereby increasing crop yield on the mobile agricultural holding. This can be completed by reconfiguring (e.g., repositioning, activating control systems within, and/or activating processing equipment within) a mobile agricultural holding by following a set of rules based on environmental indicators gleaned from the weather data with respect to crop data associated with crops grown on the mobile agricultural holding. This can enhance safety of a mobile agricultural holding, reduce pests/diseases affecting crops on a mobile agricultural holding, and improve conditions for crops grown on a mobile agricultural holding. Because mobile agricultural holdings have the added benefit of being able to be repositioned, intelligent control of where the mobile agricultural holding should be repositioned overcomes unpredictability/uncertainty (e.g., due to weather, pest migration paths, etc.) associated with traditional agricultural holdings. Further, the cost of operating a mobile agricultural holding can be reduced via the intelligent rules, cost minimization, and reward maximization functions.

[0018] Various aspects of the present disclosure are described by narrative text, flowcharts, block diagrams of computer systems and/or block diagrams of the machine logic included in computer program product (CPP) embodiments. With respect to any flowcharts, depending upon the technology involved, the operations can be performed in a different order than what is shown in a given flowchart. For example, again depending upon the technology involved, two operations shown in successive flowchart blocks may be performed in reverse order, as a single integrated step, concurrently, or in a manner at least partially overlapping in time.

[0019] A computer program product embodiment ("CPP embodiment" or "CPP") is a term used in the present disclosure to describe any set of one, or more, storage media (also called "mediums") collectively included in a set of one, or more, storage devices that collectively include machine readable code corresponding to instructions and/or data for performing computer operations specified in a given CPP claim. A "storage device" is any tangible device that can retain and store instructions for use by a computer processor. Without limitation, the computer readable storage medium may be an electronic storage medium, a magnetic storage medium, an optical storage medium, an electromagnetic storage medium, a semiconductor storage medium, a mechanical storage medium, or any suitable combination of the foregoing. Some known types of storage devices that include these mediums include: diskette, hard disk, random access memory (RAM), read-only memory (ROM), erasable programmable read-only memory (EPROM or Flash memory), static random access memory (SRAM), compact disc read-only memory (CD-ROM), digital versatile disk (DVD), memory stick, floppy disk, mechanically encoded device (such as punch cards or pits/lands formed in a major surface of a disc) or any suitable combination of the foregoing. A computer readable storage medium, as that term is used in the present disclosure, is not to be construed as storage in the form of transitory signals per se, such as radio waves or other freely propagating electromagnetic waves, electromagnetic waves propagating through a waveguide, light pulses passing through a fiber optic cable, electrical signals communicated through a wire, and/or other transmission media. As will be understood by those of skill in the art, data is typically moved at some occasional points in time during normal operations of a storage device, such as during access, de-fragmentation or garbage collection, but this does not render the storage device as transitory because the data is not transitory while it is stored.

[0020] FIG. **1** is a high-level block diagram illustrating an example computing environment **100** that can be used in implementing one or more of the methods, tools, modules, and any related functions described herein, in accordance with embodiments of the present disclosure. Computing environment **100** contains an example of an environment for the execution of at least some of the computer code involved in performing the inventive methods, such as mobile agricultural holding management code **150**. In addition, computing environment **100** includes, for example, computer **101**, wide area network (WAN) **102**, end user device (EUD) **103**, remote server **104**, public cloud **105**, and private cloud **106**. In this embodiment, computer **101** includes processor set **110** (including processing circuitry **120** and cache **121**), communication fabric **111**, volatile memory **112**, persistent storage **113** (including operating system **122** and mobile agricultural holding management code **150**, as identified above), peripheral device set **114** (including user interface (UI), device set **123**, storage **124**, and Internet of Things (IoT) sensor set **125**), and network module **115**. Remote server **104** includes remote database **130**. Public cloud **105** includes gateway **140**, cloud orchestration module **141**, host physical machine set **142**, virtual machine set **143**, and container set **144**.

[0021] Computer **101** may take the form of a desktop computer, laptop computer, tablet computer, smart phone, smart watch or other wearable computer, mainframe computer, quantum computer or any other form of computer or mobile device now known or to be developed in the future that is capable of running a program, accessing a network or querying a database, such as remote database **130**. As is well understood in the art of computer technology, and depending upon the technology, performance of a computer-implemented method may be distributed among multiple computers and/or between multiple locations. On the other hand, in this presentation of computing environment **100**, detailed discussion is focused on a single computer, specifically computer **101**, to keep the presentation as simple as possible. Computer **101** may be located in a cloud, even though it is not shown in a cloud in FIG. **1**. On the other hand, computer **101** is not required to be in a cloud except to any extent as may be affirmatively indicated.

[0022] Processor set **110** includes one, or more, computer processors of any type now known or to be developed in the future. Processing circuitry **120** may be distributed over multiple packages, for example, multiple, coordinated integrated circuit chips. Processing circuitry **120** may implement multiple processor threads and/or multiple processor cores. Cache **121** is memory that is located in the processor chip package(s) and is typically used for data or code that should be available for rapid access by the threads or cores running on processor set **110**. Cache memories are typically organized into multiple levels depending upon relative proximity to the processing circuitry. Alternatively, some or all of the cache for the processor set may be located "off chip." In some computing environments, processor set **110** may be designed for working with qubits and performing quantum computing.

[0023] Computer readable program instructions are typically loaded onto computer **101** to cause a series of operational steps to be performed by processor set **110** of computer **101** and thereby effect a computer-implemented method, such that the instructions thus executed will instantiate the methods specified in flowcharts and/or narrative descriptions of computer-implemented methods included in this document (collectively referred to as "the inventive methods"). These computer readable program instructions are stored in various types of computer readable storage media, such as cache **121** and the other storage media discussed below. The program instructions, and associated data, are accessed by processor set **110** to control and direct performance of the inventive methods. In computing environment **100**, at least some of the instructions for performing the inventive methods may be stored in mobile agricultural holding management code **150** in persistent storage **113**.

[0024] Communication fabric **111** includes the signal conduction paths that allow the various components of computer **101** to communicate with each other. Typically, this fabric is made of switches and electrically conductive paths, such as the switches and electrically conductive paths that make up buses, bridges, physical input/output ports and the like. Other types of signal communication paths may be used, such as fiber optic communication paths and/or wireless communication paths.

[0025] Volatile memory **112** is any type of volatile memory now known or to be developed in the future. Examples include dynamic type random access memory (RAM) or static type RAM. Typically, the volatile memory **112** is characterized by random access, but this is not required unless affirmatively indicated. In computer **101**, the volatile memory **112** is located in a single package and is internal to computer **101**, but, alternatively or additionally, the volatile memory **112** may be distributed over multiple packages and/or located externally with respect to computer **101**.

[0026] Persistent storage **113** is any form of non-volatile storage for computers that is now known or to be developed in the future. The non-volatility of this storage means that the stored data is maintained regardless of whether power is being supplied to computer **101** and/or directly to persistent storage **113**. Persistent storage **113** may be a read only memory (ROM), but typically at least a portion of the persistent storage allows writing of data, deletion of data and re-writing of data. Some familiar forms of persistent storage include magnetic disks and solid state storage devices. Operating system **122** may take several forms, such as various known proprietary operating systems or open source Portable Operating System Interface type operating systems that employ a kernel. The code included in mobile agricultural holding management code **150** typically includes at least some of the computer code involved in performing the inventive methods.

[0027] Peripheral device set **114** includes the set of peripheral devices of computer **101**. Data communication connections between the peripheral devices and the other components of computer **101** may be implemented in various ways, such as Bluetooth connections, Near-Field Communication (NFC) connections, connections made by cables (such as universal serial bus (USB) type cables), insertion type connections (for example, secure digital (SD) card), connections made though local area communication networks and even connections made through wide area networks such as the internet. In various embodiments, UI device set **123** may include components such as a display screen, speaker, microphone, wearable devices (such as goggles and smart watches), keyboard, mouse, printer, touchpad, game controllers, mixed reality (MR) headset, and haptic devices. Storage **124** is external storage, such as an external hard drive, or insertable storage, such as an SD card. Storage **124** may be persistent and/or volatile. In some embodiments, storage **124** may take the form of a quantum computing storage device for storing data in the form of qubits. In embodiments where computer **101** is required to have a large amount of storage (for example, where computer **101** locally stores and manages a large database) then this storage may be provided by peripheral storage devices designed for storing very large amounts of data, such as a storage area network (SAN) that is shared by multiple, geographically distributed computers. IoT sensor set **125** is made up of sensors that can be used in Internet of Things applications. For example, one sensor may be a thermometer and another sensor may be a motion detector.

[0028] Network module **115** is the collection of computer software, hardware, and firmware that allows computer **101** to communicate with other computers through WAN **102**. Network module **115** may include hardware, such as modems or Wi-Fi signal transceivers, software for packetizing and/or de-packetizing data for communication network transmission, and/or web browser software for communicating data over the internet. In some embodiments, network control functions and network forwarding functions of network module **115** are performed on the same physical hardware device. In other embodiments (for example, embodiments that utilize software-defined networking (SDN)), the control functions and the forwarding functions of network module **115** are performed on physically separate devices, such that the control functions manage several different network hardware devices. Computer readable program instructions for performing the inventive methods can typically be downloaded to computer **101** from an external computer or external storage device through a network adapter card or network interface included in network module **115**.

[0029] WAN **102** is any wide area network (for example, the internet) capable of communicating computer data over non-local distances by any technology for communicating computer data, now known or to be developed in the future. In some embodiments, the WAN may be replaced and/or supplemented by local area networks (LANs) designed to communicate data between devices located in a local area, such as a Wi-Fi network. The WAN and/or LANs typically include computer hardware such as copper transmission cables, optical transmission fibers, wireless transmission, routers, firewalls, switches, gateway computers and edge servers.

[0030] End user device (EUD) **103** is any computer system that is used and controlled by an end user (for example, a customer of an enterprise that operates computer **101**), and may take any of the forms discussed above in connection with computer **101**. EUD **103** typically receives helpful and useful data from the operations of computer **101**. For example, in a hypothetical case where computer **101** is designed to provide a recommendation to an end user, this recommendation would typically be communicated from network module **115** of computer **101** through WAN **102** to EUD **103**. In this way, EUD **103** can display, or otherwise present, the recommendation to an end user. In some embodiments, EUD **103** may be a client device, such as thin client, heavy client, mainframe computer, desktop computer and so on.

[0031] Remote server **104** is any computer system that serves at least some data and/or functionality to computer **101**. Remote server **104** may be controlled and used by the same entity that operates computer **101**. Remote server **104** represents the machine(s) that collect and store helpful and useful data for use by other computers, such as computer **101**. For example, in a hypothetical case where computer **101** is designed and programmed to provide a recommendation based on historical data, then this historical data may be provided to computer **101** from remote database **130** of remote server **104**.

[0032] Public cloud **105** is any computer system available for use by multiple entities that provides on-demand availability of computer system resources and/or other computer capabilities, especially data storage (cloud storage) and computing power, without direct active management by the user. Cloud computing typically leverages sharing of resources to achieve coherence and economies of scale. The direct and active management of the computing resources of public cloud **105** is performed by the computer hardware and/or software of cloud orchestration module **141**. The computing resources provided by public cloud **105** are typically implemented by virtual computing environments that run on various computers making up the computers of host physical machine set **142**, which is the universe of physical computers in and/or available to public cloud **105**. The virtual computing environments (VCEs) typically take the form of virtual machines from virtual machine set **143** and/or containers from container set **144**. It is understood that these VCEs may be stored as images and may be transferred among and between the various physical machine hosts, either as images or after instantiation of the VCE. Cloud orchestration module **141** manages the transfer and storage of images, deploys new instantiations of VCEs and manages active instantiations of VCE deployments. Gateway **140** is the collection of computer software, hardware, and firmware that allows public cloud **105** to communicate through WAN **102**.

[0033] Some further explanation of virtualized computing environments (VCEs) will now be provided. VCEs can be stored as "images." A new active instance of the VCE can be instantiated from the image. Two familiar types of VCEs are virtual machines and containers. A container is a VCE that uses operating-system-level virtualization. This refers to an operating system feature in which the kernel allows the existence of multiple isolated user-space instances, called containers. These isolated user-space instances typically behave as real computers from the point of view of programs running in them. A computer program running on an ordinary operating system can utilize all resources of that computer, such as connected devices, files and folders, network shares, CPU power, and quantifiable hardware capabilities. However, programs running inside a container can only use the contents of the container and devices assigned to the container, a feature which is known as containerization.

[0034] Private cloud **106** is similar to public cloud **105**, except that the computing resources are only available for use by a single enterprise. While private cloud **106** is depicted as being in communication with WAN **102**, in other embodiments a private cloud may be disconnected from the internet entirely and only accessible through a local/private network. A hybrid cloud is a composition of multiple clouds of different types (for example, private, community or public cloud types), often respectively implemented by different vendors. Each of the multiple clouds remains a separate and discrete entity, but the larger hybrid cloud architecture is bound together by standardized or proprietary technology that enables orchestration, management, and/or data/application portability between the multiple constituent clouds. In this embodiment, public cloud **105** and private cloud **106** are both part of a larger hybrid cloud.

[0035] FIG. **2** is a block diagram illustrating an example computing environment **200** in which illustrative embodiments of the present disclosure can be implemented. Computing environment **200** includes a plurality of devices **205-1**, **205-2**, . . . , **205**-N (collectively devices **205**), at least one server **235**, and a network **250**.

[0036] The devices **205** and the server **235** include one or more processors **215-1**, **215-2**, . . . , **215**-N (collectively processors **215**) and **245** and one or more memories **220-1**, **220-2**, . . . , **220**-N (collectively memories **220**) and **255**, respectively. The processors **215** and **245** can be the same as, or substantially similar to, processor set **110** of FIG. **1**. The memories **220** and **255** can be the same as, or substantially similar to volatile memory **112** and/or persistent storage **113** of FIG. **1**.

[0037] The devices **205** and the server **235** can be configured to communicate with each other through internal or external network interfaces **210-1**, **210-2**, . . . **210**-N (collectively network interfaces **210**) and **240**. The network interfaces **210** and **240** are, in some embodiments, modems or network interface cards. The network interfaces **210** and **240** can be the same as, or substantially similar to, network module **115** described with respect to FIG. **1**.

[0038] The devices **205** and/or the server **235** can be equipped with a display or monitor. Additionally, the devices **205** and/or the server **235** can include optional input devices (e.g., a keyboard, mouse, scanner, a biometric scanner, video camera, or other input device), and/or any commercially available or custom software (e.g., farming software, browser software, communications software, server software, natural language processing software, search engine and/or web crawling software, image processing software, augmented reality/virtual reality (AR/VR) software, etc.). For example, devices **205** and/or server **235** can be, or include, components/devices such as those described with respect to peripheral device set **114** of FIG. **1**. The devices **205** and/or the server **235** can be servers, desktops, laptops, or hand-held devices. The devices **205** and/or the server **235** can be the same as, or substantially similar to, computer **101**, remote server **104**, and/or EUD **103** described with respect to FIG. **1**.

[0039] The devices **205** and the server **235** can be distant from each other and communicate over a network **250**. In some embodiments, the server **235** can be a central hub from which devices **205** can establish a communication connection, such as in a client-server networking model. Alternatively, the server **235** and devices **205** can be configured in any other suitable networking relationship (e.g., in a peer-to-peer (P2P) configuration or using any other network topology).

[0040] In some embodiments, the network **250** can be implemented using any number of any suitable communications media. In embodiments, the network **250** can be the same as, or substantially similar to, WAN **102** described with respect to FIG. **1**. For example, the network **250** can be a wide area network (WAN), a local area network (LAN), an internet, or an intranet. In certain embodiments, the devices **205** and the server **235** can be local to each other and communicate via any appropriate local communication medium. For example, the devices **205** and the server **235** can communicate using a local area network (LAN), one or more hardwire connections, a wireless link or router, or an intranet. In some embodiments, the devices **205** and the server **235** can be communicatively coupled using a combination of one or more networks and/or one or more local connections. For example, the first device **205-1** can be hardwired to the server **235** (e.g., connected with an Ethernet cable) while the second device **205-2** can communicate with the server **235** using the network **250** (e.g., over the Internet).

[0041] In some embodiments, the network **250** is implemented within a cloud computing environment or using one or more cloud computing services. Consistent with various embodiments, a cloud computing environment can include a network-based, distributed data processing system that provides one or more cloud computing services. Further, a cloud computing environment can include many computers (e.g., hundreds or thousands of computers or more) disposed within one or more data centers and configured to share resources over the network **250**. In embodiments, network **250** can be coupled with public cloud **105** and/or private cloud **106** described with respect to FIG. **1**.

[0042] The server **235** includes a mobile agricultural holding management application (MAHMA) **260**. The MAHMA **260** can be configured to perform automatic mobile agricultural holding reconfiguration actions based on observed conditions. Such reconfiguration actions include repositioning a mobile agricultural holding, adjusting environmental conditions within a mobile agricultural holding, and/or issuing commands to processing equipment on a mobile agricultural holding. In embodiments, the MAHMA **260** can be a rules-based system that dictates the execution of reconfiguration actions on a mobile agricultural holding based on observed conditions (e.g., based on whether any rules are met). Such conditions can be based on weather data and crop data, to be discussed further below.

[0043] The MAHMA **260** can be configured to receive crop data associated with a mobile agricultural holding. The crop data can include past, current, or future projections of characteristics of crops associated with a mobile agricultural holding. The crop data can indicate characteristics of crops on the mobile agricultural holding such as type of crops, number of crops, area of crops, growth stage, growth timing, normalized difference vegetation index (NDVI), past yield, and projected future yield. The crop data can also indicate moisture level, fertilizer application, planting prescription, terrain, and soil maps of crops associated with a mobile agricultural holding. In embodiments, crop data can also include current instances and/or severity of disease and/or pests associated with a mobile agricultural holding. The crop data can be received from any suitable source. For example, the crop data can be received as collected by a satellite (e.g., satellite imaging), a vehicle (e.g., drone imaging or plane imaging data), manual observation, and other methods.

[0044] The MAHMA **260** can also be configured to receive weather data associated with a region in which the mobile agricultural holding is operating or will be operating. The weather data can indicate precipitation levels, cloud cover, humidity, wind, temperature, warning flags (e.g., gale warning), winter conditions, pest presence (e.g., a locust swarm path), pollen levels, and forecasted storm paths within particular geographic regions. The weather data can be historical, current, and/or projected. In embodiments, the weather data can be received as collected via satellite, manual observation, sensor networks (e.g., humidity and/or temperature sensors), external sources (e.g., weather applications), crowdsourced reports, and/or radar. The weather data can be received from any suitable source (e.g., governmental data and/or enterprise data).

[0045] The MAHMA **260** can be configured to define rules dictating conditions for execution of reconfiguration actions on a mobile agricultural holding. As discussed above, mobile agricultural holding reconfiguration actions include repositioning a mobile agricultural holding, adjusting environmental conditions within a mobile agricultural holding, and/or issuing commands to processing equipment on a mobile agricultural holding. The particular reconfiguration action to be executed can be defined in rules. For example, a first rule can dictate that based on a first set of observed conditions, the mobile agricultural holding should be repositioned from a first location to a second location. As another example, a second rule can dictate that based on a second set of observed conditions, a temperature and/or humidity level of the mobile agricultural holding should be altered (e.g., via environmental controls on the mobile agricultural holding). As another example, a third rule can dictate that based on a third set of observed conditions, a particular automated agricultural processing equipment should be activated (e.g., a combine should be activated to initiate crop collection).

[0046] The MAHMA **260** can define rules based on specific crop data and/or weather data conditions. For example, a rule can dictate that a particular crop (e.g., potatoes) requires a particular temperature, humidity, precipitation, and sun exposure range (e.g., a set of growth factors). The rule can further dictate, if any of the observed temperature, humidity, precipitation, and/or sun exposure levels are not within the acceptable range defined in the rule (e.g., the rule satisfied), a corresponding reconfiguration action is executed. For example, the rule can dictate that if the environmental temperature falls below (e.g., or exceeds) a temperature threshold, then the mobile agricultural holding will be repositioned from a first location to a second location, where the second location includes an environmental temperature within the acceptable temperature range. Any suitable crop data and/or weather data conditions can be implemented within rules for executing mobile agricultural holding configuration actions. Additional rules and use-cases will be discussed with respect to FIG. **3**.

[0047] The MAHMA **260** can be configured to analyze the crop data and weather data to determine whether any rules are satisfied (e.g., met) for executing a reconfiguration action. If no rules are satisfied, the MAHMA **260** may continue to monitor the crop and/or weather data to determine whether any rules are satisfied in the future. If a rule is satisfied, the MAHMA **260** can be configured to execute a reconfiguration action defined within the rule.

[0048] Alternatively, in embodiments, if a rule does not specify a particular configuration action to execute, the MAHMA **260** can be configured to determine the particular reconfiguration action to execute such that the rule is addressed. For example, a particular rule may indicate required environmental temperature and humidity conditions for a given crop, however, the rule may not indicate a reconfiguration action to execute based on the rule being triggered. In this case, the MAHMA **260** can be configured to determine a reconfiguration action that will address the rule. For example, the MAHMA **260** can be configured to determine a suitable location the mobile agricultural holding should be repositioned to such that the environmental temperature and humidity conditions are met. As another example, the MAHMA **260** may be configured to control environmental conditions (e.g., via temperature/humidity control equipment) on the mobile agricultural holding without requiring the mobile agricultural holding to be repositioned. Such a determination can consider the relative cost/reward for performing each reconfiguration action. For example, if repositioning incurs lower cost and/or provides better crop conditions, repositioning may be selected instead of controlling environmental conditions. As such, the MAHMA **260** can be configured to intelligently select a suitable (e.g., best or top-ranked) reconfiguration action based on comparing the costs/rewards associated with each of a plurality of different reconfiguration actions.

[0049] In some embodiments, multiple reconfiguration actions can be simultaneously determined to be executed based on a triggered rule. For example, the MAHMA **260** can determine that both repositioning the mobile agricultural holding and controlling the environment of the mobile agricultural holding should be simultaneously completed to address the rule. In embodiments, combination reconfiguration actions may be selected based on cost/reward comparison of all available options.

[0050] Upon determining the reconfiguration action to execute, the MAHMA **260** can be configured to issue (e.g., via at least one processing circuit) control signals to execute the determined reconfiguration action. For example, if the MAHMA **260** determines that the mobile agricultural holding should be repositioned from a first position to a second position, the MAHMA **260** can be configured to execute a control signal to a mobility system of the mobile agricultural holding such that the mobile agricultural holding is repositioned to the second position (e.g., automatically, without user intervention). Upon executing the reconfiguration action, crop data and/or weather data can continue to be monitored to determine whether any rules are satisfied in the future.

[0051] It is noted that FIG. **2** is intended to depict the representative major components of an example computing environment **200**. In some embodiments, however, individual components can have greater or lesser complexity than as represented in FIG. **2**, components other than, or in addition to, those shown in FIG. **2** can be present, and the number, type, and configuration of such components can vary.

[0052] While FIG. **2** illustrates a computing environment **200** with a single server **235**, suitable computing environments for implementing embodiments of this disclosure can include any number of servers. The various models, modules, systems, and components illustrated in FIG. **2** can exist, if at all, across a plurality of servers and devices. For example, some embodiments can include two servers. The two servers can be communicatively coupled using any suitable communications connection (e.g., using a WAN **102**, a LAN, a wired connection, an intranet, or the Internet).

[0053] Though this disclosure pertains to the collection of data (e.g., crop data and weather data), it is noted that in embodiments, users opt into the system. In doing so, they are informed of what data is collected and how it will be used, that any collected data may be encrypted while being used, that the users can opt-out at any time, and that if they opt out, specific data can be deleted as requested.

[0054] Referring now to FIG. **3**, shown is a block diagram illustrating an example network environment **300** in which illustrative embodiments of the present disclosure can be implemented. The network environment **300** includes a mobile agricultural holding management system (MAHMS) **305**, a client **340**, a mobile agricultural holding system **355**, a datastore **385**, and satellites **395**, each of which can be communicatively coupled for intercomponent interaction via a network **350**. In embodiments, the network **350** can be the same as, or substantially similar to, network **250** and/or WAN **102**. In embodiments, the client **340** and/or MAHMS **305** can be the same as, or substantially similar to, computer **101**, peripheral device set **114**, EUD **103**, devices **205**, and/or server **235**.

[0055] The mobile agricultural holding system **355** is an agricultural holding that can be repositioned. Thus, the mobile agricultural holding system's **355** position can be changed to account for weather conditions that are favorable for growing crops and/or avoiding pests/diseases. The mobile agricultural holding system **355** includes automated agricultural processing equipment **365**, an agricultural environmental control system **375**, and a mobile agricultural holding mobility system **380**.

[0056] The automated agricultural processing equipment **365** can include one or more devices (e.g., each having one or more processing circuits for responding to commands issued by the MAHMS **305**) for managing operations performed on the mobile agricultural holding system **355**. These operations include soil preparation, crop planting, crop harvesting, crop watering, crop analysis, fertilizing, pesticide/fungicide/herbicide application, and others. Such devices include tractors, combines (e.g., with capabilities for reaping, threshing, and winnowing, when applicable), plows, harrows, fertilizer spreaders, seeders, balers, sprayers, transplanters, mowers, water purifiers/dilutors, cultivators, irrigation systems (e.g., sprinklers and aeroponics), drones/planes and other equipment. Automated agricultural processing equipment **365** can be configured to respond to control signals issued by the MAHMS **305**. The MAHMS **305** can be configured to issue a control signal to any given device within automated agricultural processing equipment **365** to perform a specific task. As an example, the MAHMS **305** can be configured to issue a control signal to an irrigation system to provide water to crops in a given area on the mobile agricultural holding system **355** based on watering requirements. Any automated agricultural processing equipment **365** can be implemented without departing from the spirit and scope of the present disclosure.

[0057] The agricultural environmental control system **375** can be configured to control the environment for crop growth on the mobile agricultural holding system **355**. These include systems (e.g., each having one or more processing circuits for responding to commands issued by the MAHMS **305**) for temperature regulation (e.g., temperature sensors and a temperature control system, such as a heating, ventilation, and cooling (HVAC) system), humidity regulation (e.g., humidity sensors and a humidity control system), sun exposure regulation (e.g., automated retractable covers/awnings to control sun exposure), and lighting exposure. Environmental control systems can be configured to respond to control signals issued by MAHMS **305**. The MAHMS **305** can be configured to issue control signals to any given environmental control system on the mobile agricultural holding system **355** such that automated environmental control can be attained. For example, the MAHMS **305** can be configured to issue a control signal to a temperature regulation system within the mobile agricultural holding system **355** to increase the temperature within a given region on the mobile agricultural holding system **355**. Any suitable environmental control systems **375** can be implemented without departing from the spirit and scope of the present disclosure.

[0058] The mobile agricultural holding system mobility system **380** can be configured to control the movement of the mobile agricultural holding system **355**. The type of mobility system **380** implemented on the mobile agricultural holding system **355** can depend on the type of vehicle the mobile agricultural holding is implemented on. For example, for water implemented mobile agricultural holdings (e.g., floating farms), the mobility system **380** can be a boat propulsion system (e.g., an outboard engine, jet drive, inboard engine, pod drive, diesel propulsion system, surface drive, gas turbine, nuclear propulsion, propeller, pump-jet, sail drive, shaft drive or any combination thereof). For land-based applications, the mobility system **380** can be a rail-based and/or road-based mobility system. For example, the mobility system **380** can operate using mobility mechanisms available to trains, cars, trucks, and other land-based vehicles. For air-based applications, the mobility system **380** can operate using mechanisms available to airplanes, blimps, and/or zeppelins. Any suitable mobility system **380** can be implemented without departing from the spirit and scope of the present disclosure.

[0059] The MAHMS **305** can be configured to automatically monitor crop and/or weather data to determine whether any rules are met for executing mobile agricultural holding reconfiguration actions. This can be completed to provide favorable crop growth conditions and safety conditions on the mobile agricultural holding system **355** while considering costs/rewards for executing such reconfiguration actions. MAHMS **305** includes a crop data receiver **310**, a weather data receiver **315**, a mobile agricultural holding rule definer **320**, a mobile agricultural holding analysis module **325**, and a mobile agricultural holding control manager **330**. The functionalities of the crop data receiver **310**, weather data receiver **315**, mobile agricultural holding rule definer **320**, mobile agricultural holding analysis module **325**, and mobile agricultural holding control manager **330** can be processor-executable instructions that can be executed by a dedicated or shared processor using received inputs.

[0060] The crop data receiver **310** can be configured to obtain crop data associated with a mobile agricultural holding. Crop data pertains to characteristics of crops grown on the mobile agricultural holding. The crop data can be monitored, collected, or otherwise obtained continuously, intermittently, periodically, or over any other suitable interval/timing. The crop data can include past, current, or future projections of characteristics of crops associated with a mobile agricultural holding. The crop data can indicate characteristics of crops on the mobile agricultural holding such as type of crops, number of crops, area of crops, growth stage, growth timing, normalized difference vegetation index (NDVI), past yield, growth conditions/factors, and projected future yield. The crop data can also indicate moisture level, fertilizer application, planting prescription, terrain, and soil maps of crops associated with the mobile agricultural holding system **355**. In embodiments, crop data can also include current instances and/or severity of disease and/or pests associated with a mobile agricultural holding.

[0061] The crop data can be received from any suitable source. For example, the crop data can be received as agricultural satellite data **399** as collected by satellites **395**. In embodiments, the crop data can be received from automated agricultural processing equipment **365** on a mobile agricultural holding system. This can include crop analysis/diagnostic equipment (e.g., imaging equipment), vehicles operating on the mobile agricultural holding system, such as drones and/or planes configured to collect image data, and/or client **340** (e.g., mobile devices including plant analysis software). In embodiments, crop data can be manually collected by a user and input into the MAHMS **305**. Crop data can be stored as agricultural data **390** within datastore **385**, to be used by the MAHMS **305** for managing the mobile agricultural holding system **355**.

[0062] The crop data obtained by crop data receiver **310** can be implemented into rules for managing the mobile agricultural holding system **355**. Any suitable crop characteristic within crop data can be implemented into rules. For example, rules can be set for specific crop types, as each type of crop may have unique growth conditions/factors. For example, a first crop may have a first set of growth conditions (e.g., full sun, a first acceptable temperature range, a first acceptable humidity range, a first acceptable precipitation range) while a second crop can have a second set of growth conditions (e.g., partial sun, a second acceptable temperature range, a second acceptable humidity range, a second acceptable precipitation range). Each set of growth conditions for each crop type can be implemented into rules such that reconfiguration actions can be taken by the mobile agricultural holding system to ensure the growth conditions of each crop are met. Rules for reconfiguring the mobile agricultural holding can similarly be set based on crop number, growth stage, NDVI, crop number, and the like. Thus, rules for managing the mobile agricultural holding can specify that particular crop types indicated within the crop data each have a set of acceptable growth conditions. In response to determining that any growth condition values are outside of an acceptable growth value range (e.g., as defined in rules), mobile agricultural holding reconfiguration actions can be issued.

[0063] The weather data receiver **315** can be configured to receive weather data associated with the mobile agricultural holding system **355**. Weather data relates to environmental data, such as forecasted weather data, climate data, oceanic data, marine condition data, and the like within a region encompassing the mobile agricultural holding system **355**. The weather data can indicate precipitation levels, cloud cover, humidity, wind, temperature, warning flags (e.g., gale warning), winter conditions, pest presence (e.g., locust swam path), pollen levels, and forecasted storm paths. The weather data can be historical, current, and/or projected.

[0064] The weather data can be received from any suitable source. In embodiments, the weather data can be received as collected from satellites **395**, manual observation, sensor networks (e.g., sensors on the mobile agricultural holding system **355**), external sources (e.g., weather applications), crowdsourced reports, and/or radar. The weather data can be sourced from governmental data and/or enterprise data. The weather data can be monitored, collected, or otherwise obtained continuously, intermittently, periodically, or over any other suitable interval/timing.

[0065] The weather data can be implemented into rules for managing the mobile agricultural holding system **355**. For example, weather data can be relied upon for attaining favorable growth conditions for specific crops on the mobile agricultural holding system **355** are met. Similarly, weather data can be relied upon for determining whether to reposition the mobile agricultural holding system **355**, as well as the specific repositioning route to take. Various environmental conditions within weather data can be used for managing the MAHMS **305**.

[0066] The mobile agricultural holding rule definer **320** can be configured to define rules for reconfiguring the mobile agricultural holding system **355**. The rules can be set based on the crop data and weather data, such that favorable weather conditions can be attained for crops grown on the mobile agricultural holding system **355** via reconfiguration of the mobile agricultural holding system. For example, rules can be set based on sun exposure requirements for specific crops, precipitation requirements for specific crops, temperature requirements for specific crops, humidity requirements for specific crops, pests/diseases affecting crops, etc. As an example, a first crop type may require a first minimum precipitation level (e.g., 1 inch of rainfall per week), while a second crop type may require a second minimum precipitation level (e.g., 2 inches of rainfall per week). The MAHMS **305** can be configured to manage the mobile agricultural holding system **355** such that the minimum precipitation levels of the first and second crop types are met. This can include repositioning the mobile agricultural holding system **355** such that the desired precipitation levels are attained. In embodiments, automated agricultural processing equipment **365**, such as a retractable covering, can be activated to prevent precipitation in areas where rules dictate that precipitation has exceeded a maximum acceptable level.

[0067] In embodiments, rules defined by the mobile agricultural rule definer **320** can be defined based on suitable (e.g., safe) operating conditions of the mobile agricultural holding system **355**. For example, rules can be defined based on wind levels, projected storm paths, gale warning, and the like, to ensure the mobile agricultural holding system **355** safely operates. As an example, if a rule indicates that an area with a gale region is prohibited, if the rule is found to be satisfied (e.g., the mobile agricultural holding system **355** is within the gale warning region), the MAHMS **305** can be configured to execute a reconfiguration action to reposition the mobile agricultural holding system from the first position within the gale warning to a second position outside of the gale warning. The repositioning may additionally consider crop rules, such that favorable growth conditions for crops are attained as a result of the repositioning.

[0068] In embodiments, rules defined by the mobile agricultural rule definer **320** can specify particular reconfiguration actions to take if they are satisfied. For example, a rule can dictate that wind levels are required to remain below a particular threshold. The rule can further specify that if the wind level exceeds the threshold, the mobile agricultural holding system **355** is automatically repositioned to a new position with wind levels that fall below the threshold. Thus, in this instance, the rule dictates the specific reconfiguration action to take.

[0069] In embodiments, rules set by the rule definer **320** may only specify weather and crop requirements, without specifying a specific reconfiguration action to take if they are satisfied. In these instances, the analysis module **325** can be configured to determine a reconfiguration action that will address the rule (e.g., such that it is no longer satisfied). For example, the analysis module **325** can be configured to determine a suitable location the mobile agricultural holding should be repositioned to such that weather and crop requirements set forth in rules are met. As another example, the analysis module **325** can be configured to determine to control environmental conditions on the mobile agricultural holding system **355** without requiring the mobile agricultural holding to be repositioned such that weather and crop requirements set forth in the rules are met. Such a determination can consider the relative cost/reward for performing each reconfiguration action. For example, if repositioning incurs lower cost and/or provides better crop conditions, repositioning may be selected by the analysis module **325** instead of controlling environmental conditions. As such, the MAHMS **305** can be configured to intelligently select a suitable (e.g., best or top-ranked) reconfiguration action based on comparing the costs/rewards associated with each of a plurality of different reconfiguration actions.

[0070] In some embodiments, rules can dictate that multiple reconfiguration actions are simultaneously executed. For example, the analysis module **325** can determine that both repositioning the mobile agricultural holding and controlling the environment of the mobile agricultural holding should be simultaneously completed to address the rule that was triggered. In embodiments, combination reconfiguration actions may be selected based on a cost/reward comparison of all available options.

[0071] The mobile agricultural holding analysis module **325** can be configured to analyze the crop and weather data to determine whether any rules defined by the rule definer **320** are met. This can include comparing current or expected environmental conditions within weather data to rules to determine whether conditions for crop growth defined in rules are acceptable. If a rule is satisfied (e.g., conditions are not acceptable), then the analysis module **325** can be configured to determine a corresponding reconfiguration action to address the rule (e.g., such that it is no longer satisfied). In embodiments, the reconfiguration actions can be defined based on the triggered rule. That is, the triggered rule may already specify a particular reconfiguration action to take (e.g., reposition versus activate environmental control system). In embodiments where rules do not specify a specific reconfiguration action to take, the analysis module **325** can be configured to determine the reconfiguration action to take to address the rule (e.g., such that the rule is no longer satisfied). The reconfiguration actions selected to be executed by the analysis module **325** can be based on a cost/reward function, such as the cost/reward function described in FIG. **5**.

[0072] For example, if the analysis module **325** determines that repositioning the mobile agricultural holding system **355** is to be completed, the analysis module **325** can be configured to determine the location the mobile agricultural holding system **355** should be repositioned to, as well as the navigation path to take to reach the determined location to address the rule (e.g., such that the rule is no longer satisfied). As another example, if the analysis module **325** determines that activating an environmental control system is to be completed for addressing a rule, the analysis module **325** can be configured to determine a magnitude of control (e.g., a degree of temperature change, humidity change, sun exposure change, etc.) to issue to an environmental control system **375** of the mobile agricultural holding system **355** to address the rule. As another example, if the analysis module **325** determines that activating automated agricultural processing equipment **365** is to be completed, the analysis module **325** can be configured to issue a control signal to activate an automated agricultural processing equipment to address the rule (e.g., activate a sprinkler such that a desire precipitation level is achieved as defined in a rule). Each decision made by the analysis module **325** can ensure any triggered rules are addressed while minimizing cost and maximizing reward.

[0073] Upon determining the reconfiguration action to execute, the mobile agricultural holding control manager can be configured to issue (e.g., via at least one processing circuit) control signals to the mobile agricultural holding system **355** to execute the determined reconfiguration action. For example, if the analysis module **325** determines that the mobile agricultural holding should be repositioned from a first position to a second position, the control manager **330** can be configured to issue a control signal to the mobility system **380** of the mobile agricultural holding system **355** such that the mobile agricultural holding system **355** is repositioned to the second position. Upon executing the reconfiguration action, crop data and/or weather data can continue to be monitored to determine whether any rules are satisfied in the future.

[0074] It is noted that FIG. **3** is intended to depict the representative major components of an example computing environment **300**. In some embodiments, however, individual components can have greater or lesser complexity than as represented in FIG. **3**, components other than or in addition to those shown in FIG. **3** can be present, and the number, type, and configuration of such components can vary.

[0075] Referring now to FIG. **4**, shown is a flowchart of an example method **400** for managing a mobile agricultural holding, in accordance with embodiments of the present disclosure. One or more operations of method **400** can be completed by one or more processing circuits (e.g., computer **101**, devices **205**, server **235**, client **340**, mobile agricultural holding system **355**, MAHMS **305**, satellites **395**).

[0076] Method **400** initiates at operation **405**, where crop data and weather data associated with a mobile agricultural holding are received. The crop data and weather data can be the same as, or substantially similar to, the crop and weather data discussed with respect to the crop data receiver **310** and weather data receiver **315** of FIG. **3**.

[0077] The crop and weather data are analyzed at operation **410**. Analyzing the crop and weather data can be completed in the same, or a substantially similar manner, as discussed with respect to the analysis module **325** of FIG. **3**. Current or forecasted weather and crop data can be analyzed to determine whether any rules are satisfied for performing a reconfiguration action on a mobile agricultural holding system. This can include comparing growth conditions for crops (e.g., precipitation requirements, humidity requirements, temperature requirements, etc.) to current or forecasted weather conditions to determine whether reconfiguration of the mobile agricultural holding is required for maintaining/attaining acceptable growth conditions. This can further include comparing weather conditions to safety conditions defined in rules to determine whether reconfiguration of the mobile agricultural holding is required for maintaining safety conditions for operation.

[0078] A determination is made whether a rule is satisfied for mobile agricultural holding reconfiguration. This is illustrated at operation **415**. If a determination is made that a rule is not satisfied for mobile agricultural holding reconfiguration, then crop and weather data may continue to be obtained/analyzed to determine whether any rules are satisfied in the future. If a determination is made that a rule is satisfied for mobile agricultural holding reconfiguration, then a reconfiguration action to be executed for the mobile agricultural holding is determined. This is illustrated at operation **420**.

[0079] Reconfiguration actions can include repositioning the mobile agricultural holding, controlling an environment of the mobile agricultural holding, and/or controlling automated agricultural processing equipment associated with the mobile agricultural holding. The reconfiguration action to execute can be completed based on a defined rule. Alternatively, the reconfiguration action can be determined based on a cost/reward function for executing the reconfiguration action. An example cost/reward function for executing a repositioning reconfiguration action is shown in FIG. **5**.

[0080] A control signal is then issued to execute the reconfiguration action. This is illustrated at operation **425**. Operation **425** can include issuing a control signal to automated agricultural processing equipment to perform a specific task, a control signal to an environmental control system on the mobile agricultural holding to specify a particular environmental parameter change, and/or a control signal to a mobility system of the mobile agricultural holding system to reposition the mobile agricultural system from a first position to a second position.

[0081] The aforementioned operations can be completed in any order and are not limited to those described. Additionally, some, all, or none of the aforementioned operations can be completed, while still remaining within the spirit and scope of the present disclosure.

[0082] Referring now to FIG. **5**, shown is an example diagram **500** depicting cost/reward function for managing a mobile agricultural holding system, in accordance with embodiments of the present disclosure. The cost/reward function is based on repositioning a mobile agricultural holding from a first position "c" to a second position "j" on an N-grid of pixels (shown as 5×5 in FIG. **5**) as well as controlling the environment of the mobile agricultural holding. It is noted that the depicted cost/reward function for repositioning the mobile agricultural holding is merely exemplary. A different number and/or geometry of pixels can be implemented without departing from the spirit and scope of the present disclosure. Similarly, different cost/reward factors can be implemented without departing from the spirit and scope of the present disclosure.

[0083] As shown in FIG. **5**, the cost/reward function for repositioning the mobile agricultural holding from the first position "c" to the second position "j" is based on four main factors. The reward is based on an increase in crop yield resulting from repositioning and an increase in crop yield resulting from environmental control. The cost is based on energy lost due to repositioning as well as energy lost from environmental control. An optimal pixel "j" is selected based on maximizing the reward and minimizing the cost associated with managing the mobile agricultural holding. In embodiments, the above analysis can be completed in response to determining that the mobile agricultural holding should be repositioned. Thus, aspects of the present disclosure can intelligently select a desired location that a mobile agricultural holding should be repositioned to based on reward/cost factors associated therewith.

[0084] As discussed in more detail herein, it is contemplated that some or all of the operations of some of the embodiments of methods described herein may be performed in alternative orders or may not be performed at all; furthermore, multiple operations may occur at the same time or as an internal part of a larger process.

[0085] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the various embodiments. As used herein, the singular forms "a," "an," and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "includes" and/or "including," when used in this specification, specify the presence of the stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof. In the previous detailed description of example embodiments of the various embodiments, reference was made to the accompanying drawings (where like numbers represent like elements), which form a part hereof, and in which is shown by way of illustration specific example embodiments in which the various embodiments may be practiced. These embodiments were described in sufficient detail to enable those skilled in the art to practice the embodiments, but other embodiments may be used and logical, mechanical, electrical, and other changes may be made without departing from the scope of the various embodiments. In the previous description, numerous specific details were set forth to provide a thorough understanding the various embodiments. But, the various embodiments may be practiced without these specific details. In other instances, well-known circuits, structures, and techniques have not been shown in detail in order not to obscure embodiments.

[0086] Different instances of the word "embodiment" as used within this specification do not necessarily refer to the same embodiment, but they may. Any data and data structures illustrated or described herein are examples only, and in other embodiments, different amounts of data, types of data, fields, numbers and types of fields, field names, numbers and types of rows, records, entries, or organizations of data may be used. In addition, any data may be combined with logic, so that a separate data structure may not be necessary. The previous detailed description is, therefore, not to be taken in a limiting sense.

[0087] The descriptions of the various embodiments of the present disclosure have been presented for purposes of illustration, but are not intended to be exhaustive or limited to the embodiments disclosed. Many modifications and variations will be apparent to those of ordinary skill in the art without departing from the scope and spirit of the described embodiments. The terminology used herein was chosen to best explain the principles of the embodiments, the practical application or technical improvement over technologies found in the marketplace, or to enable others of ordinary skill in the art to understand the embodiments disclosed herein.

[0088] Although the present disclosure has been described in terms of specific embodiments, it is anticipated that alterations and modification thereof will become apparent to those skilled in the art. Therefore, it is intended that the following claims be interpreted as covering all such alterations and modifications as fall within the true spirit and scope of the disclosure.

What is claimed is:

1. A computer-implemented method comprising:
receiving crop data associated with a mobile agricultural holding;
receiving weather data associated with the mobile agricultural holding;
analyzing the crop data and the weather data to determine whether a rule is satisfied for reconfiguring the mobile agricultural holding; and
issuing, in response to determining that the rule is satisfied for reconfiguring the mobile agricultural holding, a control signal to at least one processing circuit of the mobile agricultural holding to execute a reconfiguration action.

2. The method of claim **1**, wherein executing the reconfiguration action includes repositioning the mobile agricultural holding from a first position to a second position.

3. The method of claim **1**, wherein executing the reconfiguration action includes activating an environmental control system on the mobile agricultural holding.

4. The method of claim **1**, wherein the rule specifies that a first crop type indicated within the crop data has a set of acceptable growth conditions, wherein the rule for reconfiguring the mobile agricultural holding is determined to be satisfied in response to a growth condition value of the first crop type being outside of an acceptable growth value range.

5. The method of claim **4**, wherein the growth condition value is a precipitation value, wherein the acceptable growth value range is a precipitation range.

6. The method of claim **4**, wherein the growth condition value is a temperature value, wherein the acceptable growth value range is a temperature range.

7. The method of claim **1**, wherein the reconfiguration action is a first reconfiguration action, wherein the first reconfiguration action is selected over a second reconfiguration action based on a reward of the first reconfiguration action exceeding a reward of the second reconfiguration action.

8. The method of claim **7**, wherein the first reconfiguration action includes repositioning the mobile agricultural holding from a first position to a second position, wherein the second reconfiguration action includes activating an environmental control system on the mobile agricultural holding.

9. The method of claim 1, wherein executing the reconfiguration action includes repositioning the mobile agricultural holding from a first position to a second position and activating an environmental control system on the mobile agricultural holding.

10. The method of claim 1, wherein the rule specifies that a first crop type indicated within the crop data has an acceptable sun exposure range, wherein the rule for reconfiguring the mobile agricultural holding is determined to be satisfied if an observed sun exposure level indicated within the weather data falls outside of the sun exposure range.

11. A system comprising:
one or more processors; and
one or more computer-readable storage media collectively storing program instructions which, when executed by the one or more processors, are configured to cause the one or more processors to perform a method comprising:
receiving crop data associated with a mobile agricultural holding;
receiving weather data associated with the mobile agricultural holding;
analyzing the crop data and the weather data to determine whether a rule is satisfied for reconfiguring the mobile agricultural holding; and
issuing, in response to determining that the rule is satisfied for reconfiguring the mobile agricultural holding, a control signal to at least one processing circuit of the mobile agricultural holding to execute a reconfiguration action.

12. The system of claim 11, wherein executing the reconfiguration action includes repositioning the mobile agricultural holding from a first position to a second position.

13. The system of claim 11, wherein the rule specifies that a first crop type indicated within the crop data has a set of acceptable growth conditions, wherein the rule for reconfiguring the mobile agricultural holding is determined to be satisfied in response to a growth condition value of the first crop type being outside of an acceptable growth value range.

14. The system of claim 11, wherein the rule specifies that the mobile agricultural holding is required to be repositioned in response to being located within a region of a warning flag, where the rule for reconfiguring the mobile agricultural holding is determined to be satisfied in response to a first position of the mobile agricultural holding being within the region of the warning flag, wherein the reconfiguration action includes repositioning the mobile agricultural holding from the first position to a second position outside of the region of the warning flag.

15. The system of claim 11, wherein the reconfiguration action is a first reconfiguration action, wherein the first reconfiguration action is selected over a second reconfiguration action based on a reward of the first reconfiguration action exceeding a reward of the second reconfiguration action.

16. A computer program product comprising one or more computer readable storage media, and program instructions collectively stored on the one or more computer readable storage media, the program instructions comprising instructions configured to cause one or more processors to perform a method comprising:
receiving crop data associated with a mobile agricultural holding;
receiving weather data associated with the mobile agricultural holding;
analyzing the crop data and the weather data to determine whether a rule is satisfied for reconfiguring the mobile agricultural holding; and
issuing, in response to determining that the rule is satisfied for reconfiguring the mobile agricultural holding, a control signal to at least one processing circuit of the mobile agricultural holding to execute a reconfiguration action.

17. The computer program product of claim 16, wherein executing the reconfiguration action includes repositioning the mobile agricultural holding from a first position to a second position.

18. The computer program product of claim 16, wherein the rule specifies that a first crop type indicated within the crop data has a set of acceptable growth conditions, wherein the rule for reconfiguring the mobile agricultural holding is determined to be satisfied in response to a growth condition value of the first crop type being outside of an acceptable growth value range.

19. The computer program product of claim 18, wherein the rule specifies that a second crop type indicated within the crop data has a second set of acceptable growth conditions, wherein the rule for reconfiguring the mobile agricultural holding is determined to be satisfied in response to a second growth condition value of the second crop type being outside of a second acceptable growth range.

20. The computer program product of claim 16, wherein the reconfiguration action is a first reconfiguration action, wherein the first reconfiguration action is selected over a second reconfiguration action based on a reward of the first reconfiguration action exceeding a reward of the second reconfiguration action.

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