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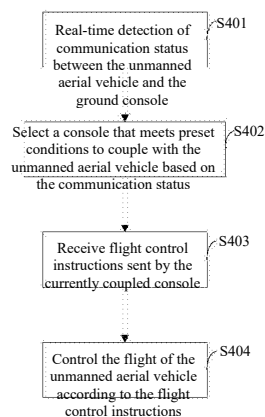
Drawing 3

(54) Name of invention

A multi-control terminal unmanned aerial vehicle and its
console and control switching method

(57) Abstract

The present invention discloses a multi-control terminal unmanned aerial vehicle and its control console and control switching method, falling into the field of unmanned aerial vehicles. The unmanned aerial vehicle comprises a first transmitter and a first receiver, and a flight control board, at least two said consoles, and further comprises a communication monitor for detecting the communication status of the unmanned aerial vehicle and the console in real time, wherein the first receiver is electrically connected to the flight control board and the communication monitor respectively, and the first receiver, according to the communication status, selects to receive flight control instructions sent from the console that meet the preset conditions and enters the flight control instructions to the flight control board. The present invention can transfer the flight control right of the unmanned aerial vehicle to another pre-set authorized console (e.g., a backup console or relay console) so that, even if the currently coupled console of the unmanned aerial vehicle fails, the control on the unmanned aerial vehicle can be effectively ensured; on the other hand, the scope of flight activity of the unmanned aerial vehicle can be expanded through such relay control of the flight control right.



CN 105334863 A

1. A multi-control unmanned aerial vehicle, which comprises a first transmitter and a first receiver for implementing two-way communication functions with a console on the ground, and a flight control board for controlling flight of the unmanned aerial vehicle, and the number of said consoles is at least two, characterized in that: It further comprises a communication monitor for detecting the communication status between the unmanned aerial vehicle and the console in real time, wherein the first receiver is electrically connected to the flight control board and the communication monitor respectively, and the first receiver, according to the communication status, selects to receive flight control instructions sent by the console that meet preset conditions and enters the flight control instructions to the flight board.

2. The multi-control terminal unmanned aerial vehicle according to claim 1, characterized in that: The communication monitor detects in real time whether the communication between the unmanned aerial vehicle and the currently coupled console is connected or disconnected, and, when it is disconnected, the first receiver switches from the currently coupled console to receive light control instruction sent by another console meeting preset conditions.

3. The multi-control terminal unmanned aerial vehicle according to claim 1 or 2, characterized in that: The communication monitor comprises a flight control instruction prediction unit, which is suitable for predicting the flight control instruction sent by a currently coupled console and received by the first receiver, and, when the flight control instruction is inappropriate or unclear, the first receiver switches from the currently coupled console to receive flight control instruction sent by another console that meets the preset conditions.

4. The multi-control terminal unmanned aerial vehicle according to claim 1, characterized in that: The communication monitor comprises a signal strength detection unit, which is suitable for detecting in real time the signal strength of the console that meets preset conditions at a current position of the unmanned aerial vehicle, and the first receiver, based on the signal strength, switches from the currently coupled console to receive flight control instructions sent by another console meeting preset conditions.

5. A multi-control terminal unmanned aerial vehicle according to anyone of claim 1 to 4, characterized in that: The communication monitor comprises an instruction comparison unit and a storage unit storing preset instructions, where the instruction comparison unit is respectively connected to the first receiver and the storage unit and is suitable for comparing the instructions received by the first receiver with the preset instructions, and, when the instructions received by the first receiver are consistent with the preset instructions, the first receiver switches from the currently coupled console to receive flight control instructions sent by another console meeting preset conditions.

6. A console, comprising a second transmitter and a second receiver for implementing two-way communication with an unmanned aerial vehicle, characterized in that: The number of said consoles is at least two and each meets the preset conditions, a console coupled with the unmanned aerial vehicle is selected according to the communication status of the unmanned aerial vehicle, and the currently coupled console sends flight control instructions to the unmanned aerial vehicle through the second transmitter.

7. A console according to claim 6, characterized in that: It further comprises an on-off module, which is electrically connected to the second transmitter and suitable for controlling the communication connection and disconnection between the console and the unmanned aerial vehicle.

8. The console according to claim 6 or 7, characterized in that: It further comprises a control switching module, which is electrically connected to the second transmitter and suitable for entering preset instructions and sending the preset instructions to the unmanned aerial vehicle via the second transmitter, and the unmanned aerial vehicle switches to the corresponding console according to the preset instructions.

9. A control switching method for an unmanned aerial vehicle, which comprises the following steps:
detecting in real time the communication status of the unmanned aerial vehicle with at least two consoles on the ground;

selecting a console meeting preset conditions according to the communication status to be coupled with the unmanned aerial vehicle;

receiving flight control instructions from the currently coupled console;

controlling flight of the unmanned aerial vehicle according to the flight control instructions.

10. A control switching method of the unmanned aerial vehicle according to claim 9, characterized in that: The communication status includes any one or any combination of the following situations:

a connected or disconnected status between the unmanned aerial vehicle and the currently coupled console;

the flight control instructions are improper or unclear;
the signal strength between the unmanned aerial vehicle and the console.

A multi-control terminal unmanned aerial vehicle and its console and control switching method**Technical Field**

[0001] The present invention relates to the technical field of unmanned aerial vehicles, specifically to a multi-control terminal unmanned aerial vehicle and its console and control switching method.

Background Art

[0002] The most popular multi-rotor unmanned aerial vehicle today is typically operated by a flying pilot to send a control instruction to the multi-rotor unmanned aerial vehicle through the console using wireless communication mode so that the unmanned aerial vehicle can fly according to the control instruction from the console. In general, the remote control device of an unmanned aerial vehicle is fixed, e.g.: A unmanned aerial vehicle is equipped with a remote control in a fixed manner, and users can only control the corresponding unmanned aerial vehicle through the equipped remote control.

[0003] For example, Chinese Patent Document Application No. 201310061550. X discloses a ground station of unmanned aerial vehicle, which comprises a wireless transmission module and a computer control platform, where the operator sends response instruction signals to control the unmanned aerial vehicle through the computer control platform and the wireless transmission module; the unmanned aerial vehicle transmits the status information to the computer control platform in real time through the wireless transmission module, and the computer control platform displays the flight status parameters of the unmanned aerial vehicle and its position status on the navigation map in real time.

[0004] In another example, the patent document of application number 201410829167.9 discloses a wireless communication-based remote unmanned aerial vehicle control system and its control method, and its system comprises a unmanned aerial vehicle group and a remote control center. The unmanned aerial vehicle group consists of a number of unmanned aerial vehicles, each comprising a second communication module and a drive module; and the remote control center comprises a first wireless communication module, a task allocation module, a signal processing module, and an initialization module. The unmanned aerial vehicle is provided with an electronic identification module and is uniquely numbered using an unmanned aerial vehicle body number, each unmanned aerial vehicle comprises a positioning module and a navigation module, and the remote control center comprises a human-machine interaction module.

[0005] In the control mode described above, there may be two situations:

[0006] Firstly, the control instruction signal of the console is lost due to a fault at the console end, and the unmanned aerial vehicle is out of control and transfers to the automatic flight or air hovering status is transferred, when flight of the unmanned aerial vehicle not under control increases the risk of unmanned aerial vehicle accidents;

[0007] Secondly, due to the varying user level of the console, especially the fact that novices may issue inappropriate control instructions repeatedly during the use of the console, the controlled unmanned aerial vehicle enters the flight hazardous area or flight hazardous state.

[0008] The commonality of the above two situations is that the unmanned aerial vehicle is stuck in a dilemma, and the reason for entering this dilemma is that the console fails to give control instructions due to an accident, or the console gives improper control instructions, which may even cause the unmanned aerial vehicle to crash in the worst case.

Invention Content

[0009] The purpose of the present invention is to provide a multi-control terminal unmanned aerial vehicle and its console and control switching method to fix the above technical problems, that is, when the unmanned aerial vehicle is in trouble, the unmanned aerial vehicle is provided with correct flight control instructions in a timely manner to help avoid flight risks; or, to expand the activity scope of the unmanned aerial vehicle and complete flight missions.

[0010] In order to solve the above technical problems, the present invention adopts the technical solution as follows:

[0011] A multi-control terminal unmanned aerial vehicle, which comprises a first transmitter and a first receiver for implementing two-way communication functions with a ground control console, and a flight control board for controlling the flight of the unmanned aerial vehicle, with the number of consoles being at least two, and further comprises a communication monitor for detecting the communication status between the unmanned aerial vehicle and the console in real time, wherein the first receiver is electrically connected to the flight control board and the communication monitor respectively, and the first receiver, according to the communication status, selects to receive flight control instructions sent by the console meeting preset conditions and enters the flight control instructions to the flight control board.

[0012] Furthermore, the communication monitor detects in real time whether the communication between the unmanned aerial vehicle and the currently coupled console is connected or disconnected, and, when they are in the disconnected state, the first receiver switches from the currently coupled console to receive flight control instruction sent by another console meeting preset functions.

[0013] Furthermore, the communication monitor comprises a flight control instruction prediction unit, which is suitable for predicting flight control instructions sent by the currently coupled console and received by the first receiver, and, when the flight control instructions are improper or unclear, the first receiver switches from the currently coupled console to receive flight control instructions sent by another console meeting preset conditions.

[0014] Furthermore, the communication monitor comprises a signal strength detection unit, which is suitable for detecting in real time the signal strength of the console meeting preset conditions at the current position of the unmanned aerial vehicle, and the first receiver, according to the signal strength, switches from the currently coupled console to receive flight control instructions sent from another console meeting preset conditions.

[0015] Furthermore, the communication monitor comprises an instruction comparison unit and a storage unit storing preset instructions, wherein the instruction comparison unit is respectively connected to the first receiver and the storage unit and is suitable for comparing the instructions received by the first receiver with the preset instructions, and, when the instructions received by the first receiver are consistent with the preset instructions, the first receiver switches from the currently coupled console to receive flight control instruction sent by the another console meeting preset conditions.

[0016] According to another aspect of the present invention, a console is provided and comprises a second transmitter and a second receiver for implementing two-way communication functions with the unmanned aerial vehicle, with the number of consoles being at least two and each meeting preset conditions, where a console coupled with the unmanned aerial vehicle is selected according to the communication status of the unmanned aerial vehicle, and the console currently coupled sends flight control instructions to the unmanned aerial vehicle through the second transmitter.

[0017] Furthermore, an on-off module is comprised and is electrically connected to the second transmitter, suitable for controlling the communication connection and disconnection between the console and the comprise.

[0018] Furthermore, a control switching module is comprised and electrically connected to the second transmitter, suitable for inputting preset instructions and sending the preset instructions to the unmanned aerial vehicle through the second transmitter, and the unmanned aerial vehicle switches to the corresponding console according to the preset instructions.

[0019] According to yet another aspect of the present invention, a control switching method for unmanned aerial vehicles is provided, comprising the following steps:

[0020] detecting the communication status of the unmanned aerial vehicle with at least two consoles on the ground in real time;

[0021] selecting a console meeting the preset conditions according to the communication status to be coupled with the unmanned aerial vehicle;

[0022] receiving flight control instructions from the currently coupled console;

[0023] controlling the flight of the unmanned aerial vehicle according to the flight control instructions.

[0024] Furthermore, said communication status covers any one or any combination of the following situations:

[0025] a connection or disconnection status between the unmanned aerial vehicle and the currently coupled console;

[0026] said flight control instructions are improper or unclear;

[0027] the signal strength between the unmanned aerial vehicle and the console.

[0028] The present invention discloses a multi-control terminal unmanned aerial vehicle and its console and control switching method, wherein, by detecting the communication status between the currently coupled console and the unmanned aerial vehicle, the flight control right of the unmanned aerial vehicle can be transferred to another pre-set authorization console (such as a backup console or a relay console) so that, even if the currently coupled console of the unmanned aerial vehicle fails, the control of the unmanned aerial vehicle can be effectively ensured; on the other hand, the flight activity scope of the unmanned aerial vehicle can be expanded through such relay control of flight control right.

[0029]The above description is only an overview of the technical solution of the present invention. In order to make the technical means of the present invention more clear, and to the extent that those skilled in the art can implement them according to the contents of the specification, and to make the above and other purposes, features and advantages of the present invention more obvious and understandable, the specific embodiments of the present invention are exemplified below.

Description of the Attached Drawings

[0030]Various other advantages and benefits of the present invention will become clear to those of ordinary skill in the art by reading the detailed description of the preferred embodiments below. The attached drawings of the specification are for the purpose of illustrating preferred embodiments only and are not to be considered a limitation of the invention. Obviously, the attached drawings described below are merely some embodiments of the present invention, and other drawings may also be obtained based on these drawings without creative labor by those of ordinary skill in the art. Also throughout the drawings, the same reference numerals are used to indicate the same components. In the drawings:

[0031] Figure 1 shows a schematic diagram of a multi-control terminal unmanned aerial vehicle and its console structure according to embodiment 1 of the present invention;

[0032] Figure 2 shows a schematic diagram of a multi-control terminal unmanned aerial vehicle and its console according to embodiment 2 of the present invention;

[0033] Figure 3 shows a schematic diagram of a multi-control terminal unmanned aerial vehicle and its console according to embodiment 3 of the present invention;

[0034] Figure 4 shows a flow chart of a control switching method for an unmanned aerial vehicle according to embodiment 4 of the present invention.

Embodiments

[0035]Specific embodiments of the present invention will be described in more detail below with reference to the attached drawings. Although specific embodiments of the present invention are shown in the attached drawings, it should be understood that the present invention can be realized in various forms and should not be limited by the embodiments set forth herein. Rather, these embodiments are provided to enable a more thorough understanding of the present invention and to convey the full scope of the present invention to those skilled in the art.

[0036]It should be noted that certain terms are used in the specification and claims to refer to specific components. Those skilled in the art should understand that hardware manufacturers may use different terms to refer to the same component. The specification and claims do not differentiate components based on differences in terms of nouns, but rather on differences in functions between components. As mentioned throughout the specification and claims, “including” or “comprising” is an open-ended term and should be interpreted as “including, but not limited to”. The subsequent description of the specification is about preferred embodiments of the present invention, but the description is intended for the general principles of the specification and is not intended to define the scope of the present invention. The scope of protection of the present invention shall be as defined by the attached claims.

[0037] To ensure easy understanding of the embodiments of the present invention, several embodiments will be further explained in conjunction with the attached drawings below, and each drawings does not constitute a limitation on the embodiments of the present invention.

[0038] Unmanned aerial vehicle (UAV) is an unmanned aircraft operated by radio remote control equipment and self-contained program control device. From a technical perspective, it can be classified into: Unmanned helicopters, unmanned fixed-wing aircrafts, unmanned multi-rotor aircraft, unmanned airships, unmanned parafoil aircrafts, etc. In recent years, with the improvement of sensor process, the advancement of microprocessor technology, the improvement of power devices and the increase of battery endurance, its applications in the military and civilian fields have been continuously expanding at a high speed, and the unmanned aerial vehicle market enjoys broad prospects.

[0039] The preferred unmanned aerial vehicle in the embodiment of the present invention is a multi-rotor unmanned aerial vehicle (or referred to as a multi-rotor aerial vehicle), which may be a quad-rotor or six-rotor unmanned aerial vehicle or an unmanned aerial vehicle with more than six rotors.

[0040] The unmanned aerial vehicles used in the technical solution of the present invention mainly refer to small and miniature multi-rotor unmanned aerial vehicles, which are characterized by small size, low cost, good flight stability, low flight cost, etc. The aircraft used in the present invention is typically represented by a four-axis multi-rotor aircraft.

[0041] Embodiment 1. A multi-control terminal unmanned aerial vehicle and its console.

[0042] Figure 1 shows a schematic diagram of a multi-control terminal unmanned aerial vehicle and its console of embodiment 1 of the present invention, and the embodiments of the present invention will be specifically explained with reference to Figure 1.

[0043] As shown in Figure 1, an embodiment of the present invention provides a multi-control terminal unmanned aerial vehicle 100 and its console 101.

[0044] The embodiments of the present invention disclose a multi-control terminal unmanned aerial vehicle 100, which comprises a first transmitter 102 and a first receiver 104 for implementing two-way communication functions with a console 101 on the ground, and a flight control board 105 for controlling flight of the unmanned aerial vehicle, with the number of consoles 101 being at least two, and further comprises a communication monitor 103 for detecting the communication status between the unmanned aerial vehicle 100 and the console 101 in real time, wherein the first receiver 104 is electrically connected to the flight control board 105 and the communication monitor 103 respectively, and the first receiver 104, according to the communication status, selects to receive flight control instructions sent by the console 101 meeting preset conditions and input the flight control instructions to said flight control board 105.

[0045] In the preferred embodiment of the present invention, said communication monitor 103 comprises a flight control instruction prediction unit, which is suitable for predicting the flight control instructions sent by the currently coupled console 101 and received by said first receiver 104, and, when said flight control instructions are improper or unclear, said first receiver 104 switches from the currently coupled console 101 to receive the flight control instructions sent by another console 101 meeting preset conditions.

[0046] In the preferred embodiment of the present invention, said communication monitor 103 comprises a signal strength detection unit, which is suitable for detecting in real time the signal strength of said console 101 meeting the preset conditions at the current position of said unmanned aerial vehicle 100, and said first receiver 104, according to the said signal strength, switches from the currently coupled console 101 to receive the flight control instructions sent by another console 101 meeting the preset conditions.

[0047] In the preferred embodiment of the present invention, the communication monitor 103 comprises an instruction comparison unit and a storage unit storing preset instructions, wherein the instruction comparison unit is respectively connected to the first receiver 104 and the storage unit, and is suitable for comparing the instructions received by the first receiver 104 with the preset instructions, and, when the instructions received by the first receiver 104 are consistent with the preset instructions, the first receiver 104 switches from the currently coupled console 101 to receive flight control instructions sent by another console 101 meeting the preset conditions. In this way, regardless of any of the above situations or unspecified situations, the flight control right can be transferred by sending a preset instruction to the unmanned aerial vehicle 100, the preset instruction can be issued by the main console or server or even a backup console described below, and, in other situations that are not exemplified in the embodiments of the present invention immediately, the flight control right can also be transferred to the desired user to be authorized.

[0048] In the preferred embodiment of the present invention, said communication monitor 103 detects in real time whether the communication between said unmanned aerial vehicle 100 and the currently coupled console 101 is connected or disconnected, and when it is in the disconnected status, said first receiver 104 switches from the currently coupled console 101 to receive another flight control instruction sent by another console 101 meeting preset conditions.

[0049] The embodiments of the present invention also disclose a console 101, which comprises a second transmitter and a second receiver for implementing two-way communication functions with a unmanned aerial vehicle 100, with the number of consoles being at least two and each console 101 meeting preset conditions, and a console 101 coupled to the unmanned aerial vehicle 100 is selected according to the communication status of the unmanned aerial vehicle 100, and the currently coupled console 101 sends flight control instructions to the unmanned aerial vehicle 100 through the second transmitter. The second transmitter and second receiver can establish a communication connection with at least one unmanned aerial vehicle to transmit data mutually, such as transmitting steering instructions to the unmanned aerial vehicle, and receiving flight status and images sent by the unmanned aerial vehicle, etc.

[0050] In the preferred embodiment of the present invention, , the console 101 further comprises an on-off module electrically connected to the second transmitter, and is suitable for controlling the communication connection and disconnection between the console and the unmanned aerial vehicle 100. Preferably, the on-off module is a controllable switch. Preferably, the controllable switch is a solenoid valve. In other embodiments, the solenoid valve can also be a contractor, electronic switch, or other controllable switches.

[0051] In the preferred embodiment of the present invention p, the console 101 further comprises a control switching module, which is electrically connected to the second transmitter, and is suitable for inputting preset instructions and sending the preset instructions to the unmanned aerial vehicle 100 through the second transmitter, and the unmanned aerial vehicle 100 switches to the corresponding console 101 according to the preset instructions.

[0052] The embodiments of the present invention also disclose a multi-control terminal system of unmanned aerial vehicle, including the above unmanned aerial vehicle and console.

[0053] In the preferred embodiment of the present invention , said system further comprises a server, which is used for controlling and monitoring all the operations on the entire unmanned aerial vehicle and all the related consoles, receives telemetry data sent from the unmanned aerial vehicle through a link communication station and sends part of the remote control instructions to it regularly, and the flight control of said unmanned aerial vehicle is achieved through a console, i.e., a wireless remote control.

[0054] Specifically, when the unmanned aerial vehicle is powered on, the remote control mode is enabled, which makes the unmanned aerial vehicle fly according to the received flight control instructions; the unmanned aerial vehicle continuously checks its own communication status and determines whether there is a problem with its communication.

[0055] In the preferred embodiment of the present invention , said console is a broad concept and can be a wireless remote control or mobile device (such as smartphone or tablet) that can be held by the flyman, or a server or ground station computer set up by the sponsor of a flight activity. In some embodiments, the console initially coupled to the unmanned aerial vehicle (where "coupling" means that the console sends flight control instructions to the unmanned aerial vehicle, and the unmanned aerial vehicle receives the flight control instructions and controls its flight according to these instructions) is called the main console or the first console, while other consoles that meet the preset conditions are called backup consoles or the relay consoles or the second console up to the Nth console, the number of the backup consoles or the relay consoles may be arbitrary and is not limited here, and they can be selected according to the specific application.

[0056] In the preferred embodiment of the present invention , the preset conditions described herein may be any one of the following or any combination thereof:

[0057] When started, the unmanned aerial vehicle completes the code matching with the console (including the console currently coupled and the backup console or the relay console). After the communication handshake, the unmanned aerial vehicle can be controlled by the flight control instructions given by the console, except that, during the period when the unmanned aerial vehicle is controlled by the flight control instructions of the currently coupled console, the unmanned aerial vehicle blocks any flight control instructions given by the backup console or the relay console, and only maintains the authorized control connection with the backup console or the relay console;

[0058] Alternatively, the currently coupled console or server includes an authorization generation module and an authorization control connection module, where the authorization generation module generates an authorization control verification code, sends the authorization control verification code to all the consoles selected as a backup console or relay console through a communication device (such as a second receiver and a second transmitter or a communication module located on the server) on it, and stores the authorization control verification code in the storage unit of the authorization generation module, and the authorization control connection module establishes an authorization control connection with the authorization generation module according to the authorization control verification code. For example, a spare console or a relay console such as B0001A is selected for the "No. 1" authorization generation module, and an authorization control verification code such as Y1234a is generated and sent to the console B0001A, and the console establishes authorization control operations with the "No. 1" authorization generation module through the authorization control verification code Y1234a;

[0059] Alternatively, the said server includes an authorization generation module, which is used for generating authorization selection instructions of the authorization console of said unmanned aerial vehicle (the authorized console here includes the main console and the backup console or the relay console), specifically an authorization selection interface is provided, and the said authorization selection interface that displays the optional authorized consoles corresponding to the unmanned aerial vehicle, and the authorization selection instructions containing the authorized console are generated according to the user's selection operation. For example: Said server includes a login module, and, when a user logs in, an optional console identifications are

displayed, selecting one of the console identifications will add the console as an authorized console of the unmanned aerial vehicle. For example, the optional console identifications shown are console No. 1, console No. 2, etc.; when the user selects console No. 1, and then the console No. 1 is added as the authorized console of the unmanned aerial vehicle.

[0060] In another embodiment of the present invention, the system also stores at least one piece of control setting data, and each piece of control setting data defines an authorized console corresponding to a certain preset address or preset time of the unmanned aerial vehicle. The authorization generation module is used to select the corresponding authorized console in the control settings data as the main console, backup console, or relay console when the unmanned aerial vehicle is located at a preset address or the current time is a preset time, and generate the authorization selection instruction. The control setting data is provided by the main control connection module of the system through a setting interface, and the user of the server sets the control setting data.

[0061] In the preferred embodiment of the present invention, said authorization control connection module is used to enable the authorization control function of the console and establish an authorization control connection between the authorized console and the corresponding unmanned aerial vehicle.

[0062] In the preferred embodiment of the present invention, said console or server includes a main control connection module.

[0063] When the main control connection module is located on the server, the server first sends a control identification code to the currently coupled console and the unmanned aerial vehicle, thereby establishing a main control connection between the currently coupled console and the unmanned aerial vehicle, and, when the server detects that the currently coupled console has a communication fault or the unmanned aerial vehicle receives improper or unclear instructions or receives a control switching instruction actively sent by the console, the server immediately sends the control identification code to another backup console or relay console that meets preset conditions, and cuts off the main control connection between the currently coupled console and the unmanned aerial vehicle.

[0064] When the main control connection module is located on the currently coupled console, it is used to send the control identification code to the corresponding unmanned aerial vehicle, the main control connection between the console and the unmanned aerial vehicle can be established (that is, the console is the currently coupled unmanned aerial vehicle), the flight control instructions sent by other consoles that meet the preset conditions are blocked, and the pilot of the currently coupled console can actively send the control identification code to another console that meets the preset conditions and is selected by the pilot according to the specific condition (for example, when the currently coupled console fails or the pilot encounters an inoperable problem), and the console meeting preset conditions immediately establishes the main control connection with the unmanned aerial vehicle through the control identification code, and switches the flight control right from the currently coupled console to another backup console or a relay console.

[0065] When the main control connection module is located in the backup console or relay console, the pilot of the backup console or relay console discovers that there is a communication fault between the currently coupled console and the unmanned aerial vehicle or the unmanned aerial vehicle receives improper instructions or unclear instructions, it can immediately establish the main control connection between the backup console or relay console and the unmanned aerial vehicle through the main control connection module.

[0066] In the preferred embodiment of the present invention, there are many ways to establish a main control connection between the control console and the unmanned aerial vehicle, which fall into the prior art, e.g., the unique identification and communication connection method of the unmanned aerial vehicle are marked on the body of the unmanned aerial vehicle or on the packaging box and in the instructions manual, the control identification code is marked on the packaging box and in the instructions manual, and the control identification code is stored in the storage unit of the unmanned aerial vehicle. When a connection is established for the first time, the unique identification and communication connection method are entered (including the method of QR code scanning) on the user interface provided by the main control connection module, and the control identification code is also entered; the control identification code is sent to the unmanned aerial vehicle through the communication device based on the communication connection method of the unmanned aerial vehicle; after verifying the control identification code stored in the storage unit, the unmanned aerial vehicle establishes a main control connection between the main control connection module and the unmanned aerial vehicle, the pilot of the currently coupled console or the user of the server can enter information about each console user, such as username and password, and maintain basic information about the unmanned aerial vehicle, such as the identification nickname of the unmanned aerial vehicle. The identification nickname, communication connection method, and even the unique identification of the unmanned aerial vehicle and the pilot username and even password will be sent to the server for storage. Then, the pilot or the user can establish a main control connection with the unmanned aerial vehicle by simply logging into the main control connection module using the user name and password.

[0067] In the preferred embodiment of the present invention , said currently coupled console is illustrated by taking a wireless remote control as an example, which can comprise a flight control joystick and system setting keys, where said flight control joystick is used to control the flight of said unmanned aerial vehicle and generate said flight control instructions, and said system setting keys are used to complete the basic settings of said console. Preferably, the currently coupled console may further include a display module, e.g., a capacitive touch screen, which can complete the display of the system interface, and zooming-in/out and input control instructions for the system interface can be completed by sliding or clicking.

[0068] In the preferred embodiment of the present invention , the first receiver 104 receives remote control instructions through a wireless link, and the first transmitter 102 sends telemetry data to a console on the ground through a wireless link to realize the data interaction between the unmanned aerial vehicle and the console.

[0069] In the preferred embodiment of the present invention , the flight control board includes a first surface and a second surface opposite the first surface. The flight control board is rectangular, the first surface comprises a flight control chip, a camera interface, an image transmission interface, and a battery interface, and the second surface comprises at least a plurality of electrical regulating elements.

[0070] In the preferred embodiment of the present invention , the camera interface and the battery interface are arranged at two end positions on the first surface, the flight control chip is arranged between the camera interface and the battery interface, and the image transmission interface is arranged between the flight control chip and the battery interface. The electrical regulating elements are respectively connected to a motor. It can be understood that the flight control chip, camera interface, image transmission interface, and battery interface can be replaced with other actually needed interfaces, and other interfaces or functional modules can also be added or reduced on the flight control board according to actual needs.

[0071] As an optional embodiment, taking the example that said console is a wireless remote control, the pilot can trigger the wireless remote control to send flight control instructions through the switches, keys, or other parts of the wireless remote control; or, when the wireless remote control has touch screen control functions, the pilot can also trigger the wireless remote control to send flight control instructions through the touch screen of the wireless remote control, which is not limited by the present invention.

[0072] As an optional embodiment, the present invention may receive flight control instructions sent by the wireless remote control in the 2.4G open frequency band, or may also receive flight control instructions sent by the wireless remote control in other agreed frequency bands, which is not limited by the present invention.

[0073] Specifically, said on-off module may be the corresponding ON and OFF buttons on the wireless remote control. When the pilot presses the ON and OFF status buttons on the wireless remote control, the communication between said console and the said unmanned aerial vehicle will be connected and disconnected respectively.

[0074] In the preferred embodiment of the present invention , the preset instructions may be numbered 1, 2, 3 through N. When the pilot of the currently coupled console enters number 1 in said control switching module, the flight control permission of the unmanned aerial vehicle switches from the currently coupled console (assuming it is a first console) to a second console, and, similarly, when the pilot of the currently coupled console enters a number N in said control switching module, the flight control right of the unmanned aerial vehicle switches from the currently coupled console (assuming it is a first console) to the console N, and so on. The currently coupled pilot can actively choose to transfer the flight control right to another corresponding console that meets the preset conditions.

[0075] In the preferred embodiment of the present invention , when there are only two consoles that meet the preset conditions (assuming they are the main console and the backup console), the control switching module may also share the ON and OFF keys of the above-mentioned switching module. For example, when the pilot quickly switches back and forth between the ON and OFF buttons on the wireless remote control three times, the wireless remote control will send the preset instructions to the unmanned aerial vehicle and transmit the preset instructions to the unmanned aerial vehicle's flight control board, so that the flight control board switches the unmanned aerial vehicle's flight control right from the main console to the backup console according to the preset instructions.

[0076] In the preferred embodiment of the present invention , said console further comprises a control module for providing a control interface for the flight pilot to carry out the main control operation and/or authorization control operation, generate corresponding flight control instructions, and send them to said unmanned aerial vehicle through the second transmitter. Preferably, the control module includes an authorization selection interface that displays a backup console or relay console for selection by the unmanned aerial vehicle, and a console that establishes a main control connection for switching flight control rights of the unmanned aerial vehicle based on the selection operation.

[0077] In the preferred embodiment of the present invention , the unmanned aerial vehicle further comprises a body made of carbon fiber material, which can greatly reduce the weight of the body under the premise of satisfying higher use strength and stiffness, thereby reducing the power demand of multi-rotor unmanned aerial vehicle and improving the maneuverability of multi-rotor unmanned aerial vehicle. Of course, in other embodiments of the present invention, the body may also be made of plastic or any other materials used arbitrarily. The body is provided with a plurality of wings that are symmetrically distributed relative to the symmetrical plane in the body, the wings including a propeller arm, each propeller arm being provided with a blade assembly at one end of the body away from the body, the blade assembly including a motor mounted on the propeller arm and a blade connected on an output shaft of the motor, each blade having an axis of rotation on the same cylindrical surface.

[0078] In the preferred embodiment of the present invention p, the electric energy of said unmanned aerial vehicle is provided by various high-energy batteries, including: solar cells, batteries, and fuel cells. The battery power supply method represented by lithium batteries is currently the most widely used. [0079] In the preferred embodiment of the present invention, the unmanned aerial vehicle further comprises a navigation positioning device. Furthermore, the navigation positioning device is a GPS or Beidou satellite positioning device, which is used to sense the latitude and longitude information of an unmanned aerial vehicle in the stereoscopic space and send it to the flight control board.

[0080] The embodiments of the present invention disclose a multi-control terminal unmanned aerial vehicle and its console. By detecting the communication status between the currently coupled console and the unmanned aerial vehicle, the flight control right of the unmanned aerial vehicle can be switched to another pre-set authorized console (such as a backup console or a relay console) so that, even if the currently coupled console of the unmanned aerial vehicle fails, the control of the unmanned aerial vehicle can be effectively ensured; on the other hand, the scope of flight activity of the unmanned aerial vehicle can be expanded through such relay control of flight control right.

[0081] Embodiment 2. A multi-control terminal unmanned aerial vehicle and its console.

[0082] Figure 2 shows a schematic diagram of the structure of a multi-control terminal unmanned aerial vehicle and its console of embodiment 2 of the present invention. The embodiments of the present invention will be specifically explained with reference to Figure 2.

[0083] As shown in Figure 2, an embodiment of the present invention provides a multi-control terminal unmanned aerial vehicle and its console, including a unmanned aerial vehicle 201, a main console 202, and a backup console 203.

[0084] the embodiments of the present invention disclose a multi-control terminal unmanned aerial vehicle 201, including a first transmitter and a first receiver for implementing two-way communication functions with a ground console (main console 202 and backup console 203) and a flight control board for controlling flight of said unmanned aerial vehicle 201, with the number of said consoles being at least two (explained in the embodiment of the present invention by both main console 202 and backup console 203, and it can be understood that the number of said backup consoles may be any number), and further including a communication monitor for detecting the communication status between said unmanned aerial vehicle 201 and main console 202 in real time, wherein said first receiver is electrically connected to said flight control board and said communication monitor respectively, said first receiver, based on the communication status, selects to receive flight control instructions sent by said backup console 203 that meet preset conditions and inputs the flight control instructions to the flight control board.

[0085] In the embodiment of the present invention, an unmanned aerial vehicle, especially a multi-rotor unmanned aerial vehicle, corresponds to a main console and a preset backup console (or controller), and, when the main console fails, e.g., communication barriers and power outages, the unmanned aerial vehicle automatically connects to another preset backup console instead of losing control signals completely.

[0086]The embodiments of the present invention addresses the problem of communication failure in the main control console by adopting a backup console for backup and a flight control right switching mechanism between the main console and the backup console..

[0087] Specifically, the flight control switching mechanism of the main console and the backup console is as follows:

[0088]When the unmanned aerial vehicle is started, the code matching and communication connection with the main console are completed, the code matching and communication connection with the backup console are also completed, after the communication handshake, the unmanned aerial vehicle can be controlled by the flight control instructions given by the main console. Only during the period that a unmanned aerial vehicle is controlled by the flight instructions of the main console, will the unmanned aerial vehicle block any flight control instructions given by the backup console, and only maintains authorization with the backup console.

[0089] When the main console does not give any flight instructions within a preset time and/or the UAV loses the communication connection with the main console and/or the main console actively gives instructions to cut off communication, at this time, the UAV first verifies the communication with the backup console, and then directly transfers the flight control to the backup console. In other words, the UAV only needs to quickly remove the control instruction mask for the backup console.

[0090]Preferred in the embodiments of the present invention, the said communication monitor verifies the connection between the said UAV and the main console in the form of a heartbeat instruction, that is, the said main console issues an instruction to the said UAV at regular intervals that does not represent any specific flight action. After receiving the said instruction, the said UAV returns an instruction to the said main console to verify and ensure that both parties have smooth communication connection.

[0091] In this way, the flight risk is greatly reduced. For many unpredictable risk situations such as inexperienced first flight pilots or possible mechanical and electronic faults in the main console, the addition of a backup console as standby control hub for emergency can effectively reduce the crash risk of the UAV.

[0092] On the other hand, when the control instructions given by the main console currently coupled to the UAV are improper or the control instructions are unclear, the backup console that issues the correct control instructions can also be effectively replaced with.

[0093]On the basis of the above inventive embodiments, when the current operator of the UAV is unable to effectively operate the UAV, it is possible to directly convert the current flight control to a pre-set standby console, and the operator of the standby console will take over the operation of the UAV.

[0094]Preferred in the embodiments of the present invention, the said standby control console may be a ground control computer or a sponsor's control device, etc.

[0095]This situation has high application value for many occasions:

[0096]For example, in the event of a UAV flight competition, when an inexperienced flier is about to lose control of the UAV due to misoperation, the experienced flier can take over the flight control of the UAV in time through the aforementioned system, and through its rich operating experience, correct the flight status of the UAV in time to avoid danger.

[0097] The entire control process uses only one frequency band to control the UAV, which can improve the UAV's safety.

[0098]Preferred in the embodiments of the present invention, the flight control board can be implemented by a central processor (CPU) and/or coprocessor, a field programmable gate array (FPGA), a digital signal processor (DSP), an application-specific basic circuit (ASIC), and an embedded microprocessor (ARM).

[0099]Preferred in embodiments of the present invention, the flight board may include one or more programmable processors and memories, and the memory is a non-volatile computer-readable medium. The processor may be connected with a non-volatile computer readable medium. The non-volatile computer-readable medium may comprise one or more storage units (e.g., removable media or external memory, such as an SD card or random memory). The storage unit of the non-volatile computer-readable medium may store code and/or program instructions. The processor executes the code and/or program instructions to execute the embodiments described herein.

[0100] Embodiments of the present invention disclose a multi-control UAV and its console, and by adopting a mechanism such as a main console and a backup console to avoid flight risks, when the main console fails, such as: communication obstacles, power outages, etc., the UAV is automatically connected to another preset backup console, so that even if the main console connected to the UAV fails, it can effectively ensure the control of the UAV.

[0101] Refer to the content of the above-mentioned embodiments of the invention for other contents of the embodiments of the present invention, and they will not be repeated here.

[0102] Embodiment 3. A multi-control UAV and its console.

[0103] Figure 3 is a schematic diagram of the structure of a multi-control UAV and its console of Embodiment 3 of the present invention. Embodiments of the present invention will be specifically explained in conjunction with Figure 3.

[0104] As shown in Fig. 3, the embodiment of the present invention provides a multi-control UAV and its console, including a UAV 301, a first console 302, a second console 303, and a third console 304. Assuming that the console currently coupled to the UAV 301 is the first console 302, and the second console 303 and the third console 304 are relay consoles. In the illustration, although only three consoles have been drawn for example illustrations, the number of the consoles is arbitrary and can be determined based on the size of the control range or the size of the aerial area.

[0105] Embodiments of the present invention disclose a multi-control UAV 301 comprising a first transmitter and a first receiver for implementing bidirectional communication functions with a ground console (first console 302, second console 303, and third console 304) and a flight control board for controlling flight of the UAV, illustrated in the illustration of the console, three examples, further comprising a communication monitor for detecting the communication status of the UAV 301 with the first console 302, second console 303, and third console 304 in real time, wherein the first receiver is electrically connected with the flight control board and the communication monitor, respectively, and the first receiver selects to receive flight control instructions sent by a console (second console 303 or third console 304) that meets preset conditions according to the communication status, and inputs the flight control instructions to the flight control board.

[0106] Preferred in the embodiments of the present invention, the communication monitor includes a signal strength detection unit adapted to detect in real time the signal strength of the console that meets the preset conditions in the current position of the unmanned aerial vehicle 301, and the first receiver toggles from the currently coupled console (first console 301) according to the signal strength to receive flight control instructions sent by another console that meets the preset conditions (second console 303 or third console 304).

[0107] Embodiments of the present invention solve the relay problem of more than two consoles, and the flight control switching mechanism of the first console, the second console and the Nth console is adopted in this solution.

[0108] Specifically, multiple consoles correspond to the flight control switching mechanism in the case of one UAV:

[0109] The above-mentioned embodiments of the invention are mainly directed at the mechanism of flight risk avoidance such as the main console and standby console of a UAV. In fact, the idea of using multi-console rotation to control a UAV can achieve more purposes.

[0110] For example, currently multi-rotor UAVs are mainly operated within the range of view. Even if the pilot has very rich experience in operation, it is generally difficult to move the pilot along with the UAV to adjust the UAV's flight range. In other words, UAVs are generally more common within 800 meters away from the pilot. However, in fact, the UAV's mobility is far beyond this range, so in this case, the console cannot move easily, which limits the UAV's range of motion.

[0111] As shown in the figure, if you set up three consoles, namely the first, second and third, corresponding to one UAV, you can easily expand the UAV's range of motion by nearly three times by switching flight control in time within the three control areas of the three consoles.

[0112] Preferred in the embodiments of the present invention, the switching of flight control may be the active authorized transfer between the pilots, such as first manipulating the UAV by the No. 1 pilot. When it is found that the UAV is close to the control range of the No. 3 pilot, and the flight mission will be completed within the control range, the No. 1 pilot decides to transfer the flight control to the No. 3 pilot.

[0113] Preferred in the embodiments of the present invention, the switching of said flight control may also be automatic switching by the UAV according to the signal strength from each console. For example, when the UAV is in Region No. 1, the flight control of Console No. 1 is automatically activated; when the UAV is in the wrong region and is about to enter Region No. 3, the UAV identifies that the signal strength of Console No. 3 in region No. 3 is greatly enhanced and automatically switches the flight control to Flier No. 3. Since there is only a flight instruction for controlling the UAV at a time, there will be no conflict over the control instructions. Moreover, each flier only needs to focus on the maneuvering of the UAV without worrying about the timing of the transfer of flight control. This is more efficient for flight missions requiring a high degree of connectivity.

[0114] Preferred in the embodiments of the present invention, it is possible to achieve one-to-many signal coupling through simple modifications mainly based on the current common 2.4 GHz wireless network environment. Instead of going through the complex equipment verification and signal processing processes in the mobile communication environment, this only requires full authorization verification and permission switching between a UAV and multiple consoles. Then, when the consoles are spread over different locations, the UAV's range of activity can be greatly expanded.

[0115] In addition, when multiple consoles are in the same area, the above mechanism, in turn, adds one or more guarantees to the control mechanism of the UAV. Even if there is a problem with the control mechanism of one of the consoles, it will automatically switch to the control mechanism that is still effective to manage the flight process of the UAV.

[0116] Preferred in the embodiments of the present invention, the said UAV is equipped with a GPS unit, which communicates with the satellite system. The UAV's status acquisition module calls the GPS unit and uses the satellite system to locate the UAV to obtain its current position.

[0117] Preferred in the embodiments of the present invention, the said UAV is provided with an attitude measurement module. Of course, the said attitude measurement module is not limited to being provided on the said UAV, but may also be mounted on it, such as on a gimbal mounted on the said UAV, for detecting the flight attitude information in real-time, such as the pitch and roll angles of the flight heading, flight altitude, flight speed, etc.

[0118] Embodiments of the present invention disclose a multi-control UAV and its console. Through a swift UAV flight control relay, it is possible to control the UAV in relays in a larger scope through the relay of two or more fliers, thereby completing flight tasks (e.g. large-area aerial photography occasions).

[0119] Refer to the content of the above-mentioned embodiments of the invention for other contents of the embodiment of the present invention, which will not be repeated here.

[0120] Embodiment 4. A control switching method for UAVs.

[0121] Fig. 4 is the flow chart of the control switching method of the UAV of Embodiment 4 of the present invention, and the embodiments of the present invention will be specified in combination with Fig. 4.

[0122] As shown in Fig. 4, an embodiment of the present invention provides a control switching method for UAVs, including the following steps:

[0123] Step S401: Detecting in real-time the status of communication between the said UAV and at least two consoles on the ground;

[0124] Step S402: Selecting a console that meets the pre-set conditions to be coupled with the UAV according to the communication status;

[0125] Step S403: Receiving flight control instructions from the console with which the UAV is being coupled;

[0126] Step S404: Controlling the flight of the said UAV according to the said flight control instructions.

[0127] Preferred in the embodiments of the present invention, the said communication status includes any type of the following circumstances or any combination thereof:

[0128] The status of connection or disconnection between the said UAV and the console with which the UAV is being coupled;

- [0129] The said flight control instructions are improper or unclear;
- [0130] The strength of signals between the said UAV and the console.
- [0131] Preferred in the embodiments of the present invention, when the communication between the console with which the UAV is being coupled and the said UAV is disconnected, the flight control is transferred to another console that meets the pre-set conditions.
- [0132] Preferred in the embodiments of the present invention, when the flight control instructions issued by the said console with which the UAV is being coupled are improper or unclear, the flight control is transferred to another console that meets the pre-set conditions.
- [0133] Preferred in the embodiments of the present invention, when the strength of communication signals between the said console with which the UAV is being coupled and the said UAV is weaker than that between another console that meets the pre-set conditions and the said UAV, the flight control is transferred to another console that meets the pre-set conditions.
- [0134] Preferred in the embodiments of the present invention, before said step S401, it further includes the authorization process between said console and said UAV. Specifically:
- [0135] Said UAV pairs code with the console with which the UAV is being coupled (main console or first console) and establishes a communication connection. At the same time, the said UAV also pairs code with the authorized console (backup console or second console and Console No. N) and establishes communication;
- [0136] Said UAV only receives flight control instructions sent by the said console with which the UAV is being coupled in normal communication status and blocks flight control instructions sent by the said authorized console.
- [0137] An embodiment of the present invention discloses a control switching method for UAVs. By detecting the status of communication between the console with which the UAV is being coupled and the UAV, the flight control of the UAV can be transferred to another pre-set authorized console (e.g. a backup console or a relay console), so that even if the console with which the UAV is being coupled fails, the control of the UAV can be effectively ensured. Additionally, the range of flight activity of the UAV can be expanded through such relay control of the flight control.
- [0138] Refer to the content of the above-mentioned embodiments of the invention for other contents of the embodiments of the present invention, which will not be repeated here.
- [0139] The present invention can provide these beneficial technical effects: The multi-control UAV, its console and control switching method disclosed in the embodiment of the present invention can transfer the flight control of the UAV to another pre-set authorized console (e.g. a backup console or a relay console) by detecting the status of communication between the console with which the UAV is being coupled and the UAV. In this way, even if the console with which the UAV is being coupled fails, the control of the UAV can be effectively ensured. Additionally, the range of flight activity of the UAV can be expanded through such relay control of the flight control.
- [0140] It is clear that various modifications and variations of the present invention can be made by those skilled in this field without departing from the spirit and scope of the present invention. In this way, if these modifications and variations of the present invention fall within the scope of the claims of the present invention and its equivalent technology, the present invention is also intended to include these modifications and variations.

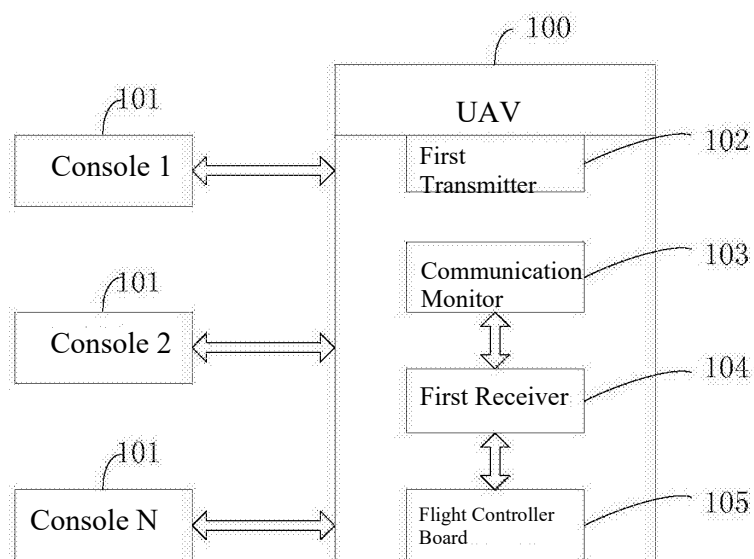


Fig. 1

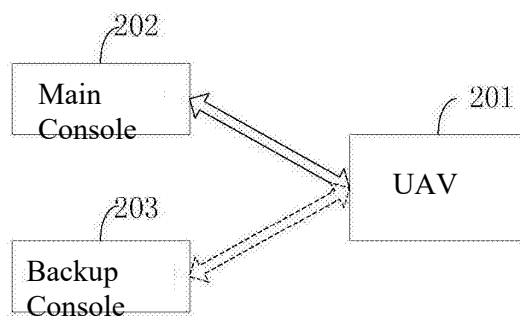


Fig. 2

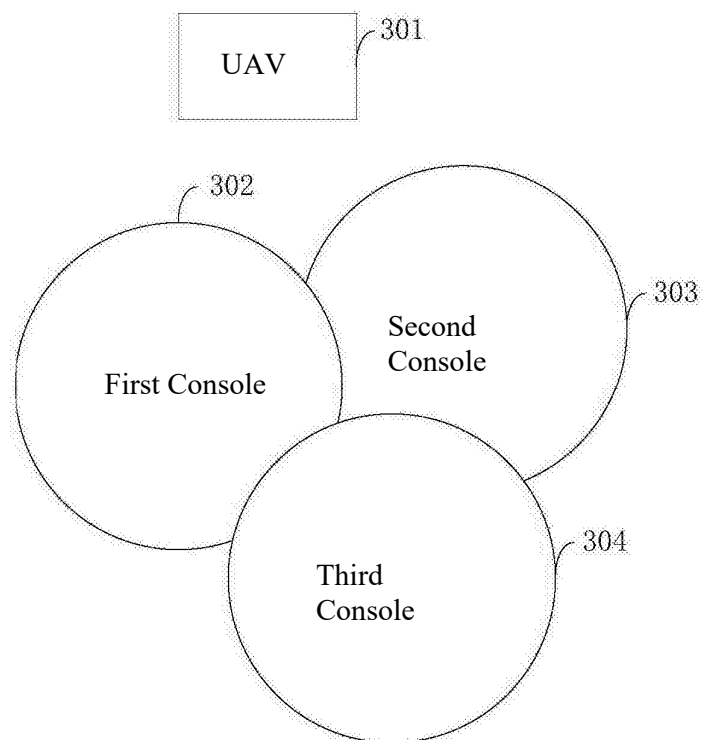


Fig. 3

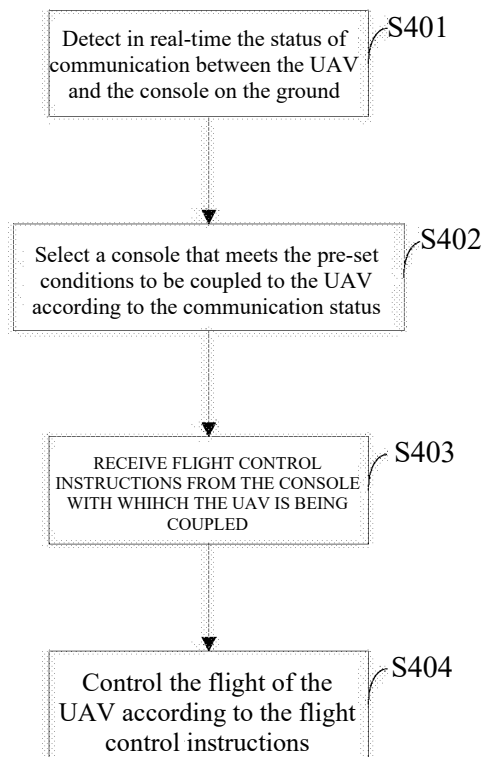
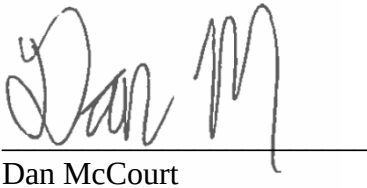


Fig. 4



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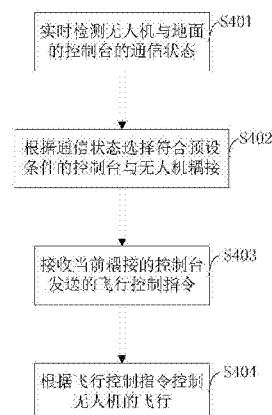
权利要求书2页 说明书12页 附图3页

(54) 发明名称

一种多控制端的无人机及其控制台和控制切换方法

(57) 摘要

本发明公开了一种多控制端的无人机及其控制台和控制切换方法,属于无人机领域。该无人机包括第一发射器和第一接收器以及飞控板,所述控制台至少为两个,还包括用于实时检测无人机与控制台的通信状态的通信监测器,其中,第一接收器分别与飞控板和通信监测器电连接,第一接收器根据通信状态选择接收符合预设条件的控制台发送的飞行控制指令,并将飞行控制指令输入至飞控台。本发明可以将该无人机的飞行控制权切换转移至另一预先设置的授权控制台(例如备用控制台或者接力控制台),这样,即使无人机当前耦接的控制台发生故障,也能有效的确保对该无人机的控制;另一方面,也可以通过这种飞行控制权的接力控制,扩大无人机的飞行活动范围。



1. 一种多控制端的无人机,包括用于与地面的控制台实现双向通信功能的第一发射器和第一接收器以及用于控制所述无人机飞行的飞控板,所述控制台至少为两个,其特征在于:还包括用于实时检测所述无人机与控制台的通信状态的通信监测器,其中,所述第一接收器分别与所述飞控板和所述通信监测器电连接,所述第一接收器根据所述通信状态选择接收符合预设条件的控制台发送的飞行控制指令,并将所述飞行控制指令输入至所述飞控台。

2. 根据权利要求1所述的多控制端的无人机,其特征在于:所述通信监测器实时检测所述无人机与当前耦接的控制台的通信是连接还是断开状态,当处于断开状态时,所述第一接收器从当前耦接的控制台切换接收另一符合预设条件的控制台发送的飞行控制指令。

3. 根据权利要求1或2所述的多控制端的无人机,其特征在于:所述通信监测器包括飞行控制指令预判单元,其适用于对所述第一接收器接收的当前耦接的控制台发送的飞行控制指令进行预判,当所述飞行控制指令不当或者不清晰时,所述第一接收器从当前耦接的控制台切换接收另一符合预设条件的控制台发送的飞行控制指令。

4. 根据权利要求1所述的多控制端的无人机,其特征在于:所述通信监测器包括信号强度检测单元,其适用于实时检测所述无人机处于当前位置的符合预设条件的所述控制台的信号强度,所述第一接收器根据所述信号强度从当前耦接的控制台切换接收另一符合预设条件的控制台发送的飞行控制指令。

5. 根据权利要求1至4任一所述的多控制端的无人机,其特征在于:所述通信监测器包括指令比较单元和存储预设指令的存储单元,所述指令比较单元分别与所述第一接收器和所述存储单元连接,其适用于将所述第一接收器接收的指令与所述预设指令进行比较,当所述第一接收器接收到的指令与所述预设指令一致时,所述第一接收器从当前耦接的控制台切换接收另一符合预设条件的控制台发送的飞行控制指令。

6. 一种控制台,包括用于与无人机实现双向通信功能的第二发射器和第二接收器,其特征在于:所述控制台至少为两个且各控制台符合预设条件,并且根据与所述无人机的通信状态选择与所述无人机组接的控制台,当前耦接的控制台通过所述第二发射器向所述无人机发送飞行控制指令。

7. 根据权利要求6所述的控制台,其特征在于:还包括通断模块,所述通断模块与所述第二发射器电连接,其适用于控制所述控制台与所述无人机之间的通信连接和断开。

8. 根据权利要求6或7所述的控制台,其特征在于:还包括控制切换模块,所述控制切换模块与所述第二发射器电连接,其适用于输入预设指令,并通过所述第二发射器将所述预设指令发送至所述无人机,所述无人机根据所述预设指令切换至相应的控制台。

9. 一种无人机的控制切换方法,包括以下步骤:

实时检测所述无人机与地面的至少两个控制台的通信状态;

根据所述通信状态选择符合预设条件的控制台与所述无人机组接;

接收当前耦接的控制台发送的飞行控制指令;

根据所述飞行控制指令控制所述无人机的飞行。

10. 根据权利要求9所述的无人机的控制切换方法,其特征在于:所述通信状态包括以下情形中的任意一种或者任意组合:

所述无人机与当前耦接的控制台之间的连接或断开状态;

所述飞行控制指令不当或者不清晰；
所述无人机与控制台之间的信号强度。

一种多控制端的无人机及其控制台和控制切换方法

技术领域

[0001] 本发明涉及无人机技术领域,具体涉及一种多控制端的无人机及其控制台和控制切换方法。

背景技术

[0002] 当前最为热门的多旋翼式无人机的典型操控方式,是由一位飞手通过控制台,利用无线通信方式,对多旋翼式无人机发出控制指令,而无人机则根据来自控制台的控制指令飞行。一般而言,某一台无人机的遥控设备都是固定的,例如:一台无人机固定配备有一个遥控器,用户只能通过配备的遥控器遥控对应的无人机。

[0003] 例如,中国专利文献申请号 201310061550.X 中公开了一种无人机地面站,包括无线传输模块和计算机控制平台,操控员通过计算机控制平台,无线传输模块发出响应指令信号控制无人机;无人机通过无线传输模块实时将状态信息传给计算机控制平台,计算机控制平台实时显示无人机飞行状态参数以及其在导航图的位置状态。

[0004] 再例如,申请号 201410829167.9 的专利文献公开了一种基于无线通讯的远程无人机控制系统及其控制方法,其系统包括无人机组和远程控制中心。所述无人机组包括若干架无人机,所述每架无人机包括第二通讯模块和驱动模块;所述远程控制中心包括第一无线通讯模块、任务分配模块、信号处理模块和初始化模块。无人机设置有电子识别模块,并以无人机机身编号唯一编号,每台无人机包括定位模块和导航模块,所述远程控制中心包括人机交互模块。

[0005] 在如上所述的控制方式下,可能存在如下两种情况:

[0006] 其一,由于控制台端的故障,导致控制台的控制指令信号丢失,无人机失去了控制,而转让自动飞行或者空中悬停状态,此时,这种无控制下的无人机飞行,增加了无人机发生事故的风险;

[0007] 其二,由于使用控制台的用户水平不一,尤其是新手可能在使用控制台的过程中,屡屡发出不适当的控制指令,使得被控制的无人机进入了飞行危险区域或者飞行危险状态。

[0008] 上述两种情况的共性在于,无人机陷入了困境,而进入这种困境的原因来自于控制台因某种事故导致无法给出控制指令,或者控制台给出的不当控制指令,最严重的时候甚至可能导致该无人机坠机。

发明内容

[0009] 本发明的发明目的是提供一种多控制端的无人机及其控制台和控制切换方法,解决上述技术问题,就是当无人机陷入困境时,给无人机及时提供正确的飞行控制指令,帮助无人机规避飞行风险;或者,扩大该无人机的活动范围,完成飞行任务。

[0010] 为了解决上述技术问题,本发明采用的技术方案如下:

[0011] 一种多控制端的无人机,包括用于与地面的控制台实现双向通信功能的第一发射

器和第一接收器以及用于控制所述无人机飞行的飞控板,所述控制台至少为两个,还包括用于实时检测所述无人机与控制台的通信状态的通信监测器,其中,所述第一接收器分别与所述飞控板和所述通信监测器电连接,所述第一接收器根据所述通信状态选择接收符合预设条件的控制台发送的飞行控制指令,并将所述飞行控制指令输入至所述飞控台。

[0012] 进一步的,所述通信监测器实时检测所述无人机与当前耦接的控制台的通信是连接还是断开状态,当处于断开状态时,所述第一接收器从当前耦接的控制台切换接收另一符合预设条件的控制台发送的飞行控制指令。

[0013] 进一步的,所述通信监测器包括飞行控制指令预判单元,其适用于对所述第一接收器接收的当前耦接的控制台发送的飞行控制指令进行预判,当所述飞行控制指令不当或者不清晰时,所述第一接收器从当前耦接的控制台切换接收另一符合预设条件的控制台发送的飞行控制指令。

[0014] 进一步的,所述通信监测器包括信号强度检测单元,其适用于实时检测所述无人机处于当前位置的符合预设条件的所述控制台的信号强度,所述第一接收器根据所述信号强度从当前耦接的控制台切换接收另一符合预设条件的控制台发送的飞行控制指令。

[0015] 进一步的,所述通信监测器包括指令比较单元和存储预设指令的存储单元,所述指令比较单元分别与所述第一接收器和所述存储单元连接,其适用于将所述第一接收器接收的指令与所述预设指令进行比较,当所述第一接收器接收到的指令与所述预设指令一致时,所述第一接收器从当前耦接的控制台切换接收另一符合预设条件的控制台发送的飞行控制指令。

[0016] 根据本发明的另一个方面,提供了一种控制台,包括用于与无人机实现双向通信功能的第二发射器和第二接收器,所述控制台至少为两个且各控制台符合预设条件,并且根据与所述无人机的通信状态选择与所述无人机组接的控制台,当前耦接的控制台通过所述第二发射器向所述无人机发送飞行控制指令。

[0017] 进一步的,还包括通断模块,所述通断模块与所述第二发射器电连接,其适用于控制所述控制台与所述无人机之间的通信连接和断开。

[0018] 进一步的,还包括控制切换模块,所述控制切换模块与所述第二发射器电连接,其适用于输入预设指令,并通过所述第二发射器将所述预设指令发送至所述无人机,所述无人机根据所述预设指令切换至相应的控制台。

[0019] 根据本发明的再一个方面,提供了无人机的控制切换方法,包括以下步骤:

[0020] 实时检测所述无人机与地面的至少两个控制台的通信状态;

[0021] 根据所述通信状态选择符合预设条件的控制台与所述无人机组接;

[0022] 接收当前耦接的控制台发送的飞行控制指令;

[0023] 根据所述飞行控制指令控制所述无人机的飞行。

[0024] 进一步的,所述通信状态包括以下情形中的任意一种或者任意组合:

[0025] 所述无人机与当前耦接的控制台之间的连接或断开状态;

[0026] 所述飞行控制指令不当或者不清晰;

[0027] 所述无人机与控制台之间的信号强度。

[0028] 本发明公开了一种多控制端的无人机及其控制台和控制切换方法,通过检测当前耦接的控制台与无人机之间的通信状态,可以将该无人机的飞行控制权切换转移至另一预

先设置的授权控制台（例如备用控制台或者接力控制台），这样，即使无人机当前耦接的控制台发生故障，也能有效的确保对该无人机的控制；另一方面，也可以通过这种飞行控制权的接力控制，扩大无人机的飞行活动范围。

[0029] 上述说明仅是本发明技术方案的概述，为了能够使得本发明的技术手段更加清楚明白，达到本领域技术人员可依照说明书的内容予以实施的程度，并且为了能够让本发明的上述和其它目的、特征和优点能够更明显易懂，下面以本发明的具体实施方式进行举例说明。

附图说明

[0030] 通过阅读下文优选的具体实施方式中的详细描述，本发明各种其他的优点和益处对于本领域普通技术人员将变得清楚明了。说明书附图仅用于示出优选实施方式的目的，而并不认为是对本发明的限制。显而易见地，下面描述的附图仅仅是本发明的一些实施例，对于本领域普通技术人员来讲，在不付出创造性劳动的前提下，还可以根据这些附图获得其他的附图。而且在整个附图中，用相同的附图标记表示相同的部件。在附图中：

[0031] 图 1 示出了根据本发明实施例一的多控制端的无人机及其控制台结构示意图；

[0032] 图 2 示出了根据本发明实施例二的多控制端的无人机及其控制台结构示意图；

[0033] 图 3 示出了根据本发明实施例三的多控制端的无人机及其控制台结构示意图；

[0034] 图 4 示出了根据本发明实施例四的无人机的控制切换方法流程图。

具体实施方式

[0035] 下面将参照附图更详细地描述本发明的具体实施例。虽然附图中显示了本发明的具体实施例，然而应当理解，可以以各种形式实现本发明而不应被这里阐述的实施例所限制。相反，提供这些实施例是为了能够更透彻地理解本发明，并且能够将本发明的范围完整的传达给本领域的技术人员。

[0036] 需要说明的是，在说明书及权利要求当中使用了某些词汇来指称特定组件。本领域技术人员应可以理解，硬件制造商可能会用不同名词来称呼同一个组件。本说明书及权利要求并不以名词的差异来作为区分组件的方式，而是以组件在功能上的差异来作为区分的准则。如在通篇说明书及权利要求当中所提及的“包含”或“包括”为一开放式用语，故应解释成“包含但不限于”。说明书后续描述为实施本发明的较佳实施方式，然所述描述乃以说明书的一般原则为目的，并非用以限定本发明的范围。本发明的保护范围当视所附权利要求所界定者为准。

[0037] 为便于对本发明实施例的理解，下面将结合附图以几个具体实施例为例做进一步的解释说明，且各个附图并不构成对本发明实施例的限定。

[0038] 无人飞行器简称“无人机”，英文缩写为“UAV(unmanned aerial vehicle)”，是利用无线电遥控设备和自备的程序控制装置操纵的不载人飞机。从技术角度定义可以分为：无人直升机、无人固定翼机、无人多旋翼飞行器、无人飞艇、无人伞翼机等。近年来，随着传感器工艺的提高、微处理器技术的进步、动力装置的改善以及电池续航能力的增加，使其在军事、民用方面的用途不断高速拓展，无人机市场具有广阔前景。

[0039] 本发明实施例中优选的无人机为多旋翼无人飞行器（或称为多旋翼飞行器），可

以是四旋翼、六旋翼及旋翼数量大于六的无人飞行器。

[0040] 本发明技术方案采用的无人机主要是指小、微型多旋翼无人飞行器,这种无人飞行器体积小、成本低、飞行稳定性较好,飞行成本低等。本发明使用的飞行器,典型的以四轴多旋翼飞行器为代表。

[0041] 实施例一、一种多控制端的无人机及其控制台。

[0042] 图 1 为本发明实施例一的多控制端的无人机及其控制台结构示意图,本发明实施例将结合图 1 进行具体说明。

[0043] 如图 1 所示,本发明实施例提供了一种多控制端的无人机 100 及其控制台 101。

[0044] 本发明实施例公开了一种多控制端的无人机 100,包括用于与地面的控制台 101 实现双向通信功能的第一发射器 102 和第一接收器 104 以及用于控制所述无人机飞行的飞控板 105,所述控制台 101 至少为两个,还包括用于实时检测所述无人机 100 与控制台 101 的通信状态的通信监测器 103,其中,所述第一接收器 104 分别与所述飞控板 105 和所述通信监测器 103 电连接,所述第一接收器 104 根据所述通信状态选择接收符合预设条件的控制台 101 发送的飞行控制指令,并将所述飞行控制指令输入至所述飞控板 105。

[0045] 本发明实施例中优选的,所述通信监测器 103 包括飞行控制指令预判单元,其适用于对所述第一接收器 104 接收的当前耦接的控制台 101 发送的飞行控制指令进行预判,当所述飞行控制指令不当或者不清晰时,所述第一接收器 104 从当前耦接的控制台 101 切换接收另一符合预设条件的控制台 101 发送的飞行控制指令。

[0046] 本发明实施例中优选的,所述通信监测器 103 包括信号强度检测单元,其适用于实时检测所述无人机 100 处于当前位置的符合预设条件的所述控制台 101 的信号强度,所述第一接收器 104 根据所述信号强度从当前耦接的控制台 101 切换接收另一符合预设条件的控制台 101 发送的飞行控制指令。

[0047] 本发明实施例中优选的,所述通信监测器 103 包括指令比较单元和存储预设指令的存储单元,所述指令比较单元分别与所述第一接收器 104 和所述存储单元连接,其适用于将所述第一接收器 104 接收的指令与所述预设指令进行比较,当所述第一接收器 104 接收到的指令与所述预设指令一致时,所述第一接收器 104 从当前耦接的控制台 101 切换接收另一符合预设条件的控制台 101 发送的飞行控制指令。这样,不管属于上述或者未指明的任何情况,均可以通过向所述无人机 100 发送一条预设指令将飞行控制权进行转移,所述预设指令可以由下述的主控制台或者服务器甚至备用控制台发出,即时存在本发明实施例中所未例举的其他情况,也可以将飞行控制权转移给其希望授权的用户。

[0048] 本发明实施例中优选的,所述通信监测器 103 实时检测所述无人机 100 与当前耦接的控制台 101 的通信是连接还是断开状态,当处于断开状态时,所述第一接收器 104 从当前耦接的控制台 101 切换接收另一符合预设条件的控制台 101 发送的飞行控制指令。

[0049] 本发明实施例还公开了一种控制台 101,包括用于与无人机 100 实现双向通信功能的第二发射器和第二接收器,所述控制台至少为两个且各控制台 101 符合预设条件,并且根据与所述无人机 100 的通信状态选择与所述无人机 100 耦接的控制台 101,当前耦接的控制台 101 通过所述第二发射器向所述无人机 100 发送飞行控制指令。所述第二发射器和第二接收器可与至少一个无人机建立通讯连接相互传输数据,例如向该无人机传送操控指令、接收无人机发送的飞行状态及图像等。

[0050] 本发明实施例中优选的,所述控制台 101 还包括通断模块,所述通断模块与所述第二发射器电连接,其适用于控制所述控制台与所述无人机 100 之间的通信连接和断开。优选的,所述通断模块为可控开关。优选的,所述可控开关为电磁阀。其他的实施例中,所述电磁阀还可以是接触器、电子开关等其它的可控开关。

[0051] 本发明实施例中优选的,所述控制台 101 还包括控制切换模块,所述控制切换模块与所述第二发射器电连接,其适用于输入预设指令,并通过所述第二发射器将所述预设指令发送至所述无人机 100,所述无人机 100 根据所述预设指令切换至相应的控制台 101。

[0052] 本发明实施例还公开了一种无人机的多控制端系统,包括上述的无人机和控制台。

[0053] 本发明实施例中优选的,所述系统还包括服务器,所述服务器用于控制和监控整个无人机和所有相关的控制台的全部操作,所述服务器通过链路通信站接收所述无人机发送的遥测数据并定时向其发送部分遥控指令,对所述无人机的飞行控制是通过控制台即无线遥控器来实现的。

[0054] 具体的,当所述无人机上电启动遥控模式,使所述无人机按照接收到的所述飞行控制指令飞行;所述无人机不断检测自身的通信状态,判断其通信是否出现问题。

[0055] 本发明实施例中优选的,所述控制台是一个广泛的概念,可以是飞手可以手持的无线遥控器、移动设备(智能手机或平板电脑等),还可以是某次飞行活动的主办方设置的服务器或者地面站计算机。在某些实施例中,最初与所述无人机耦接的控制台(这里“耦接”的意思是该控制台向所述无人机发送飞行控制指令,并且所述无人机接收所述飞行控制指令,并根据所述飞行控制指令控制其飞行)称为主控制台或者第一控制台,而符合预设条件的其他控制台称为备用控制台或者接力控制台或者第二控制台直至第 N 控制台,所述备用控制台或者接力控制台的数目可以是任意的,在此不对其做出限定,可以根据具体的应用场合进行选择。

[0056] 本发明实施例中优选的,这里所述预设条件可以是如下中的任意一种或者其任意组合:

[0057] 所述无人机在启动时,完成与控制台(包括当前耦接的控制台和备用控制台或者接力控制台)的对码,经过通信握手之后,所述无人机能够受到所述控制台给出的飞行控制指令的控制,只是在无人机受到所述当前耦接的控制台的飞行控制指令控制期间,所述无人机屏蔽掉所述备用控制台或者接力控制台所给出的任何飞行控制指令,仅保持与所述备用控制台或者接力控制台之间的授权控制连接;

[0058] 或者,所述当前耦接的控制台或者服务器包括一授权产生模块和授权控制连接模块,所述授权产生模块产生一授权控制验证码,通过其上的通讯装置(例如第二接收器和第二发射器或者位于所述服务器上的通讯模块)发送所述授权控制验证码至所有选择为备用控制台或者接力控制台,并且在所述无人机的存储单元中存储该授权控制验证码,所述授权控制连接模块是为根据所述授权控制验证码与所述无人机建立授权控制连接。例如为“1 号”无人机选定一备用控制台或者待接力控制台如 B0001A,则产生一授权控制验证码如 Y1234a 给该控制台 B0001A,该控制台通过该授权控制验证码 Y1234a 与“1 号”无人机建立授权控制操作;

[0059] 或者,所述服务器包括授权产生模块,该授权产生模块用于产生所述无人机的授

权控制台的授权选择指令（这里的授权控制台包括主控制台和备用控制台或接力控制台），具体为提供一授权选择界面，该授权选择界面显示对应无人机供选择的授权控制台，根据用户选择操作产生该包含有授权控制台的授权选择指令。例如：所述服务器包括有一登录模块，当一用户登录后，显示可选的控制台标识，选择其中一个控制台标识，即将该控制台加为该无人机的授权控制台。例如，显示的可选控制台标识有控制台 1 号、控制台 2 号等，用户选择控制台 1 号，那该控制台 1 号就被加为该无人机的授权控制台。

[0060] 在本发明的另一实施例中，所述系统还存储有至少一控制设置资料，每一控制设置资料定义有无人机于某一预设地址或预设时间对应的授权控制台，所述授权产生模块是为无人机位于某一预设地址或当前时间为预设时间时，选取控制设置资料中对应的授权控制台为主控制台和备用控制台或接力控制台，产生该授权选择指令。该控制设置资料是由所述系统的主控连接模块提供一设置界面，所述服务器的用户设置该控制设置资料。

[0061] 本发明实施例中优选的，所述授权控制连接模块用于开启控制台的授权控制功能，建立授权控制台与相应无人机的授权控制连接。

[0062] 本发明实施例中优选的，所述控制台或者服务器包括主控连接模块。

[0063] 当所述主控连接模块位于所述服务器上，则所述服务器首先将控制识别码发送至所述当前耦接的控制台和所述无人机，从而建立所述当前耦接的控制台与所述无人机之间的主控连接，当所述服务器通过其监控发现所述当前耦接的控制台发生通信故障或者所述无人机接收到不当指令或者不清晰指令时或者收到所述控制台主动发出的控制切换指令时，所述服务器立即将所述控制识别码发送至另一符合预设条件的备用控制台或者接力控制台，并切断所述当前耦接的控制台与所述无人机之间的主控连接。

[0064] 当所述主控连接模块位于所述当前耦接的控制台上，用于将控制识别码发送相应的无人机，就可以建立该控制台与所述无人机之间的可控连接（即该控制台为当前耦接的无人机），屏蔽掉其它符合预设条件的控制台发送的飞行控制指令，所述当前耦接的控制台的飞手可以根据具体情况（例如，该当前耦接的控制台发生故障或者飞手遇到无法操控的问题时）主动将该控制识别码发送至其选择的另一符合预设条件的控制台，该符合预设条件的控制台通过所述控制识别码立即建立与所述无人机之间的可控连接，即将飞行控制权从所述当前耦接的控制台切换至另一备用控制台或者接力控制台。

[0065] 当所述主控连接模块位于所述备用控制台或者接力控制台时，所述备用控制台或者接力控制台的飞手发现所述当前耦接的控制台与所述无人机之间出现通信故障或者所述无人机接收到不当指令或者不清晰指令时，其可以通过所述主控连接模块发送控制识别码立即建立所述备用控制台或者接力控制台与所述无人机之间的可控连接。

[0066] 本发明实施例中优选的，所述控制台与所述无人机建立可控连接的方式很多，为现有技术，例如所述无人机的机身上或包装盒、说明书中标记有该无人机的唯一标识及通讯连接方式，包装盒、说明书标记有控制识别码，同时无人机的存储单元中存储有控制识别码。在首次建立连接时，在所述主控连接模块所提供的用户界面输入（包括通过二维码扫描的方式）唯一标识及通讯连接方式，并输入控制识别码，该控制识别码通过通讯装置根据无人机的通讯连接方式发送给所述无人机，无人机根据存储单元中存储的控制识别码进行验证后建立所述主控连接模块与无人机的可控连接，所述当前耦接的控制台的飞手或者服务器的用户可录入各控制台用户的资讯，例如用户名、密码等，并维护该无人机的基本资

讯,例如无人机的标识别称。该无人机的标识别称、通讯连接方式甚至是唯一标识及飞手的用户名、甚至是密码等会发生给服务器进行存储。而后,飞手或者用户只需通过用户名、密码登录主控连接模块,即可建立与所述无人机的连接。

[0067] 本发明实施例中优选的,所述当前耦接的控制台以无线遥控器为例进行说明,该无线遥控器可以飞行控制摇杆和系统设置按键,所述飞行控制摇杆用来对所述无人机的飞行进行控制,产生所述飞行控制指令,所述系统设置按键用来完成对所述控制台的基本设置。优选的,所述当前耦接的控制台还可以包括显示模块,例如电容触摸屏,可以完成对系统界面的显示,通过滑动或者点击对系统界面进行缩放和输入控制指令。

[0068] 本发明实施例中优选的,所述第一接收器 104 通过无线链路接收遥控指令,所述第一发射器 102 通过无线链路发送遥测数据到地面的控制台,实现所述无人机与所述控制台的数据交互。

[0069] 本发明实施例中优选的,所述飞控板包括第一表面以及与第一表面相背的第二表面。所述飞控板成矩形,所述第一表面上包括飞控芯片、摄像机接口、图传接口以及电池接口,所述第二表面至少包括多个电调元件。

[0070] 本发明实施例中优选的,所述摄像机接口与所述电池接口分设在所述第一表面的两个端部位置,所述飞控芯片设置在所述摄像机接口与所述电池接口之间,所述图传接口设置在所述飞控芯片与所述电池接口之间。所述电调元件分别与一个马达连接。可以理解的是,所述飞控芯片、摄像机接口、图传接口、电池接口可以更换为其它实际所需接口,而且所述飞控板上还可根据实际需要,增加或减少其它接口或功能模块。

[0071] 作为一种可选的实施方式,以所述控制台为无线遥控器为例,飞手可以通过无线遥控器的开关、按键等来触发无线遥控器发送飞行控制指令;或者,在无线遥控器具备触摸屏控制功能时,飞手也可以通过无线遥控器的触摸屏来触发无线遥控器发送飞行控制指令,本发明不作限定。

[0072] 作为一种可选的实施方式,本发明可以接收无线遥控器以 2.4G 开放频段发送的飞行控制指令,或者,也可以接收无线遥控器以其它约定频段发送的飞行控制指令,本发明不作限定。

[0073] 具体的,所述通断模块可以为无线遥控器上对应的 ON 和 OFF 按键,当飞手在无线遥控器上的 ON 与 OFF 这两个状态按键上分别按下时,即分别会导致所述控制台与所述无人机之间的通信连接和通信断开。

[0074] 本发明实施例中优选的,所述预设指令可以是数字 1、2、3 直至 N,当所述当前耦接的控制台的飞手在所述控制切换模块输入数字 1 时,所述无人机的飞行控制权从所述当前耦接的控制台(假设为第一控制台)切换至第二控制台,同理,当所述当前耦接的控制台的飞手在所述控制切换模块输入数字 N 时,所述无人机的飞行控制权从所述当前耦接的控制台(假设为第一控制台)切换至第 N 控制台,以此类推,所述当前耦接的飞手可以主动选择将飞行控制权转移至相应的另一符合预设条件的控制台。

[0075] 本发明实施例中优选的,当只存在两个符合预设条件的控制台时(假设为主控制台和备用控制台),所述控制切换模块还可以共用上述通断模块的 ON 和 OFF 按键,例如,当飞手在无线遥控器上的 ON 与 OFF 按键这两个状态快速来回切换三下时,无线遥控器会发送所述预设指令给无人机,并将所述预设指令传输给所述无人机的飞控板,以使所述飞控板

按照所述预设指令的指示将所述无人机的飞行控制权从所述主控制台切换至所述备用控制台。

[0076] 本发明实施例中优选的,所述控制台还包括操控模块,用于提供操控界面供飞手进行主控操作和/或授权控制操作,产生相应的飞行控制指令,并通过所述第二发射器发送给所述无人机。优选的,所述操控模块包括一授权选择界面,所述授权选择界面显示所述无人机供选择的备用控制台或者接力控制台,根据选择操作产生所述无人机的飞行控制权切换的建立主控连接的控制台。

[0077] 本发明实施例中优选的,所述无人机还包括机体,所述机体由碳纤维材料制成,在满足较高使用强度和刚度的前提下,可大幅减轻机体的重量,从而降低多旋翼式无人机的动力需求以及提高多旋翼式无人机的机动性。当然,在本发明的其他实施例中,机体还可以由塑料或者其他任意使用的材料制成。所述机体上设有多个相对于所述机体中的对称平面呈对称分布的所述机翼,所述机翼包括桨臂,每一个桨臂远离所述机体的一端设有桨叶组件,所述桨叶组件包括安装在所述桨臂上的电机和连接在所述电机的输出轴上的桨叶,每一片桨叶的旋转轴线均位于同一圆柱面上。

[0078] 本发明实施例中优选的,所述式无人机的电能由各种高能电池提供,包括:太阳能、蓄电池和燃料电池。其中以锂电池为代表的蓄电池供电方式是目前应用最广泛的一种。

[0079] 本发明实施例中优选的,所述无人机还包括导航定位装置。进一步的,所述导航定位装置为 GPS 或者北斗卫星定位装置,其用于感应无人飞行器在立体空间的经纬度信息,并发送给所述飞控板。

[0080] 本发明实施例公开了一种多控制端的无人机及其控制台,通过检测当前耦接的控制台与无人机之间的通信状态,可以将该无人机的飞行控制权切换转移至另一预先设置的授权控制台(例如备用控制台或者接力控制台),这样,即使无人机当前耦接的控制台发生故障,也能有效的确保对该无人机的控制;另一方面,也可以通过这种飞行控制权的接力控制,扩大无人机的飞行活动范围。

[0081] 实施例二、一种多控制端的无人机及其控制台。

[0082] 图 2 为本发明实施例 2 的多控制端的无人机及其控制台结构示意图,本发明实施例将结合图 2 进行具体说明。

[0083] 如图 2 所示,本发明实施例提供了一种多控制端的无人机及其控制台,包括无人机 201、主控制台 202 和备用控制台 203。

[0084] 本发明实施例公开了一种多控制端的无人机 201,包括用于与地面的控制台(主控制台 202 和备用控制台 203)实现双向通信功能的第一发射器和第一接收器以及用于控制所述无人机 201 飞行的飞控板,所述控制台至少为两个(本发明实施例中以主控制台 202 和备用控制台 203 两个进行说明,可以理解的是,所述备用控制台的数量可以为任意多个),还包括用于实时检测所述无人机 201 与主控制台 202 的通信状态的通信监测器,其中,所述第一接收器分别与所述飞控板和所述通信监测器电连接,所述第一接收器根据所述通信状态选择接收符合预设条件的备用控制台 203 发送的飞行控制指令,并将所述飞行控制指令输入至所述飞控台。

[0085] 本发明实施例中,一台无人机,尤其是多旋翼式无人机对应一个主控制台和一个预先设置的备用控制台(或称为控制器),当所述主控制台发生故障时,如:通信障碍、断电

等,则无人机自动连接到另一个预先设置的备用控制台,而不是完全丢失控制信号。

[0086] 本发明实施例针对主控制台通信故障问题,采取备用控制台备份、并且主控制台和备用控制台的飞行控制权切换机制。

[0087] 具体的,所述主控制台和备用控制台的飞行控制权切换机制:

[0088] 所述无人机在启动时,在完成与所述主控制台之间的对码和通信连接时,同时还完成与所述备用控制台之间的对码和通信连接,经过通信握手后,所述无人机能够受到所述主控制台给出的飞行控制指令的控制。只是在无人机受到所述主控制台的飞行指令控制期间,所述无人机屏蔽掉所述备用控制台所给出的任何飞行控制指令,仅保持与所述备用控制台之间的授权。

[0089] 当所述主控制台在一段预设时间内没有给出任何飞行指令和/或无人机丢失了与所述主控制台之间的通信连接和/或所述主控制台主动给出了切断通信的指令,此时,所述无人机首先验证与所述备用控制台之间的通信情况,然后将飞行控制权转移到所述备用控制台,换句话说,无人机只要迅速解除对于备用控制台的控制指令屏蔽即可。

[0090] 本发明实施例中优选的,所述通信监测器以心跳指令形式来验证所述无人机与所述主控制台之间的连接,也就是所述主控制台每隔一定时间向所述无人机发出一个并不代表任何具体飞行动作的指令,所述无人机接收到该指令后,向所述主控制台返回一个指令,从而验证并确保双方处于通信畅通的状态下。

[0091] 通过这样的方式,极大降低了飞行风险。对于第一飞手经验不丰富或者主控制台可能存在机械、电子故障等众多不可预知的风险情形而言,增加了一个备用控制台作为应急备用的控制中枢,能够有效降低无人机的坠机风险。

[0092] 而另一方面,当所述无人机当前所耦接的所述主控制台给出的控制指令不当或者控制指令不清晰时,也能有效的替换发出正确的控制指令的备用控制台。

[0093] 在上述发明实施例的基础上,当无人机当前的操控者出现了无法有效操控无人机的情形时,能够简单快捷的直接将当前飞行控制权转换给预先设置好的备用控制台,由备用控制台的操控者来接手无人机的操控。

[0094] 本发明实施例中优选的,所述的备用控制台,可以是地面控制计算机或者主办方控制装置等。

[0095] 这种情况对于很多场合,都有较高的应用价值:

[0096] 例如,在无人机飞行比赛的场合,当经验不丰富的飞手因为误操作导致无人机即将失控的时候,经验丰富的飞手能够经由上述系统及时接管对于该无人机的飞行控制权,并通过其丰富的操作经验,及时纠正无人机的飞行状态,避免产生危险。

[0097] 整个控制过程中,只采用一个频段对无人机进行控制,能够提高无人机的安全性。

[0098] 本发明实施例中优选的,所述飞控板能够通过中央处理器(CPU)和/或协处理器、现场可编程门阵列(FPGA)、数字信号处理器(DSP)、特定用途基础电路(ASIC)以及嵌入式微处理器(ARM)实现。

[0099] 本发明实施例中优选的,所述飞控板可以包括一个或多个可编程处理器和存储器,所述存储器为非易失性计算机可读介质。所述处理器可以与非易失性计算机可读介质连接。所述非易失性计算机可读介质可以包括一个或多个存储单元(例如可移动介质或外部存储器,如SD卡或随机存储器)。所述非易失性计算机可读介质的存储单元可以存储代

码及 / 或程序指令。所述处理器执行该代码及 / 或程序指令,以执行本说明书描述的实施例。

[0100] 本发明实施例公开了一种多控制端的无人机及其控制台,通过采用一台无人机存在主控制台和备用控制台这样的规避飞行风险的机制,当所述主控制台发生故障时,如:通信障碍、断电等,则无人机自动连接到另一个预先设置的备用控制台,这样即使无人机所对应的主控制台发生故障,也能有效的确保对该无人机的控制。

[0101] 本发明实施例中其它内容参见上述发明实施例中的内容,在此不再赘述。

[0102] 实施例三、一种多控制端的无人机及其控制台。

[0103] 图 3 为本发明实施例三的多控制端的无人机及其控制台结构示意图,本发明实施例将结合图 3 进行具体说明。

[0104] 如图 3 所示,本发明实施例提供了一种多控制端的无人机及其控制台,包括无人机 301、第一控制台 302、第二控制台 303、第三控制台 304,假设与所述无人机 301 当前耦接的控制台为所述第一控制台 302,所述第二控制台 303 和第三控制台 304 为接力控制台,图示中,虽然仅画出了三个控制台用于示例性说明,但实际上,所述控制台的数目是任意的,可以根据控制范围的大小或航拍面积的大小确定。

[0105] 本发明实施例公开了一种多控制端的无人机 301,包括用于与地面的控制台(第一控制台 302、第二控制台 303 和第三控制台 304)实现双向通信功能的第一发射器和第一接收器以及用于控制所述无人机飞行的飞控板,所述控制台图示中以三个为例进行说明,还包括用于实时检测所述无人机 301 与所述第一控制台 302、第二控制台 303 和第三控制台 304 的通信状态的通信监测器,其中,所述第一接收器分别与所述飞控板和所述通信监测器电连接,所述第一接收器根据所述通信状态选择接收符合预设条件的控制台(第二控制台 303 或第三控制台 304)发送的飞行控制指令,并将所述飞行控制指令输入至所述飞控板。

[0106] 本发明实施例中优选的,所述通信监测器包括信号强度检测单元,其适用于实时检测所述无人机 301 处于当前位置的符合预设条件的所述控制台的信号强度,所述第一接收器根据所述信号强度从当前耦接的控制台(第一控制台 301)切换接收另一符合预设条件的控制台(第二控制台 303 或第三控制台 304)发送的飞行控制指令。

[0107] 本发明实施例解决的是两个以上控制台接力的问题,本方案中采用第一控制台、第二控制台、直至第 N 控制台的飞行控制权切换机制。

[0108] 具体的,多个控制台对应一台无人机情况下的飞行控制权切换机制:

[0109] 上述发明实施例主要是针对一台无人机存在主控制台和备用控制台这样的规避飞行风险的机制。实际上,利用多控制台轮转控制一台无人机的思路,还能实现更多用途。

[0110] 例如,当前多旋翼式无人机主要是在视距范围内操作,即使飞手的操作经验非常丰富,但是一般也很难实现飞手跟着无人机一块儿移动,来调整无人机的飞行范围。换句话说,无人机一般也就是在飞手周围 800 米范围内活动比较常见。但是,实际上无人机的活动能力是远超过这个范围的,所以,这种情况下,控制台不能便捷的移动,这一点限制了无人机的活动范围。

[0111] 如图所示,如果设置与一台无人机对应的第一、第二、第三等三个控制台,那么通过在三个控制台的三个控制区域内及时进行飞行控制权切换,就能很方便的将无人机的活动范围扩大到原来的将近 3 倍。

[0112] 本发明实施例中优选的,所述飞行控制权的切换可以是飞手之间进行主动的授权转让,比如首先由 1 号飞手操纵所述无人机,当发现所述无人机已经接近 3 号飞手的控制范围、并且接下来还将在其控制范围内完成飞行任务,此时由 1 号飞手决定将飞行控制权转给 3 号飞手。

[0113] 本发明实施例中优选的,所述飞行控制权的切换还可以是无人机根据来自各个控制台的信号强度来自动切换,比如,当无人机在 1 号区域内,自动激活 1 号控制台的飞行控制权;而当该无人机飞行错区,并即将进入 3 号区域时,该无人机判断到 3 号区域内 3 号控制台的信号强度大大增强,则将飞行控制权自动切换到 3 号飞手之下。由于同时能够控制无人机的飞行指令仅只有一路,因此,并不会出现控制指令冲突的情况,而各个飞手只用专心于无人机的操纵,无需另行担忧转移飞行控制权的时机问题,对于高衔接度要求的飞行任务来说,更加有效率。

[0114] 本发明实施例中优选的,可以主要基于现在常见的 2.4GHz 无线网络环境,进行简单的改造就能实现一对多的信号耦合,不需要利用移动通信环境下,复杂的设备验证与信号处理过程,只需要通过一台无人机与多个控制台之间进行了充分授权验证和权限切换,那么在控制台位于不同地段时,即可极大扩充无人机的活动范围。

[0115] 另外,当多个控制台处于同一区域内时,通过上述机制,又相当于给无人机的控制机制加了一道或者多道保险,即使其中某个控制台的控制机制出现了问题,也会自动切换到仍然有效的控制机制来管理该无人飞行器的飞行过程。

[0116] 本发明实施例中优选的,所述无人机上具有 GPS 单元,该 GPS 单元与卫星系统进行通讯,无人机状态获取模块调用 GPS 单元,并利用卫星系统对该无人机进行定位,获得当前位置。

[0117] 本发明实施例中优选的,所述无人机上设有姿态测量模块,当然该姿态测量模块不限于设置在该无人机上,还可以是搭载在该无人机上,如设于搭载在该无人机上的云台上,用于实时检测飞行姿态信息,例如飞行航向俯仰横滚角、飞行高度、飞行速度等等。

[0118] 本发明实施例公开了一种多控制端的无人机及其控制台,通过迅速快捷的无人机飞行控制权接力,能够借由 2 个或者多个飞手的接力,在更大范围内实现接力控制无人机,完成飞行任务(例如,对于大面积的航拍场合)。

[0119] 本发明实施例中其它内容参见上述发明实施例中的内容,在此不再赘述。

[0120] 实施例四、一种无人机的控制切换方法。

[0121] 图 4 为本发明实施例四的无人机的控制切换方法流程图,本发明实施例将结合图 4 进行具体说明。

[0122] 如图 4 所示,本发明实施例提供了一种无人机的控制切换方法,包括以下步骤:

[0123] 步骤 S401:实时检测所述无人机与地面的至少两个控制台的通信状态;

[0124] 步骤 S402:根据所述通信状态选择符合预设条件的控制台与所述无人机耦接;

[0125] 步骤 S403:接收当前耦接的控制台发送的飞行控制指令;

[0126] 步骤 S404:根据所述飞行控制指令控制所述无人机的飞行。

[0127] 本发明实施例中优选的,所述通信状态包括以下情形中的任意一种或者任意组合:

[0128] 所述无人机与当前耦接的控制台之间的连接或断开状态;

[0129] 所述飞行控制指令不当或者不清晰；

[0130] 所述无人机与控制台之间的信号强度。

[0131] 本发明实施例中优选的，当所述当前耦接的控制台与所述无人机之间的通信断开时，将所述飞行控制权切换至另一符合预设条件的控制台。

[0132] 本发明实施例中优选的，当所述当前耦接的控制台发出的飞行控制指令不当或者不清晰时，将所述飞行控制权切换至另一符合预设条件的控制台。

[0133] 本发明实施例中优选的，当所述当前耦接的控制台与所述无人机之间的通信信号强度弱于另一符合预设条件的控制台与所述无人机之间的信号强度时，将所述飞行控制权切换至另一符合预设条件的控制台。

[0134] 本发明实施例中优选的，所述步骤 S401 之前，还包括所述控制台与所述无人机之间的授权过程，具体为：

[0135] 所述无人机与当前耦接的控制台（主控制台或者第一控制台）对码并建立通信连接，同时，所述无人机还与授权控制台（备用控制台或者第二控制台、第 N 控制台）对码并建立通信；

[0136] 所述无人机在正常通信状态下，仅接收所述当前耦接的控制台发送的飞行控制指令，屏蔽掉所述授权控制台发送的飞行控制指令。

[0137] 本发明实施例公开了一种无人机的控制切换方法，通过检测当前耦接的控制台与无人机之间的通信状态，可以将该无人机的飞行控制权切换转移至另一预先设置的授权控制台（例如备用控制台或者接力控制台），这样，即使无人机当前耦接的控制台发生故障，也能有效的确保对该无人机的控制；另一方面，也可以通过这种飞行控制权的接力控制，扩大无人机的飞行活动范围。

[0138] 本发明实施例中其它内容参见上述发明实施例中的内容，在此不再赘述。

[0139] 本发明可以带来这些有益的技术效果：本发明实施例公开的多控制端的无人机及其控制台和控制切换方法，通过检测当前耦接的控制台与无人机之间的通信状态，可以将该无人机的飞行控制权切换转移至另一预先设置的授权控制台（例如备用控制台或者接力控制台），这样，即使无人机当前耦接的控制台发生故障，也能有效的确保对该无人机的控制；另一方面，也可以通过这种飞行控制权的接力控制，扩大无人机的飞行活动范围。

[0140] 显然，本领域的技术人员可以对本发明进行各种改动和变型而不脱离本发明的精神和范围。这样，倘若本发明的这些修改和变型属于本发明权利要求及其等同技术的范围之内，则本发明也意图包含这些改动和变型在内。

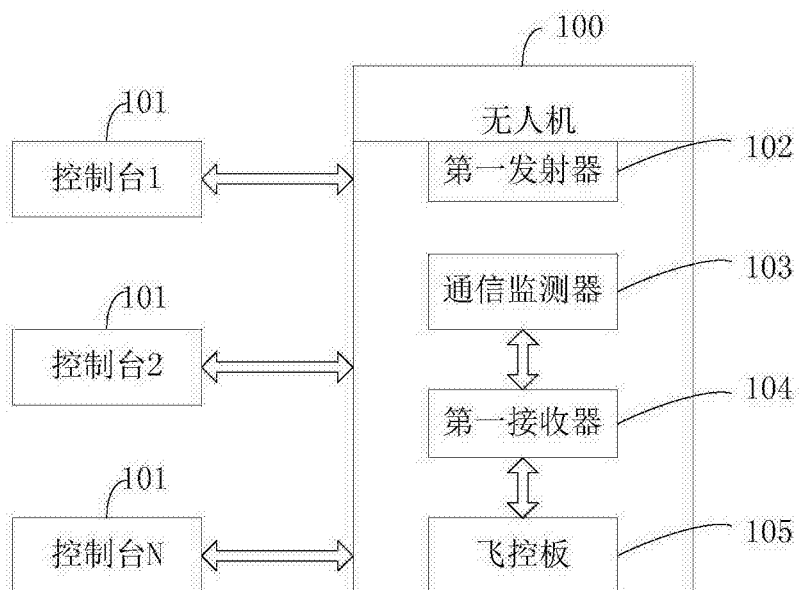


图 1

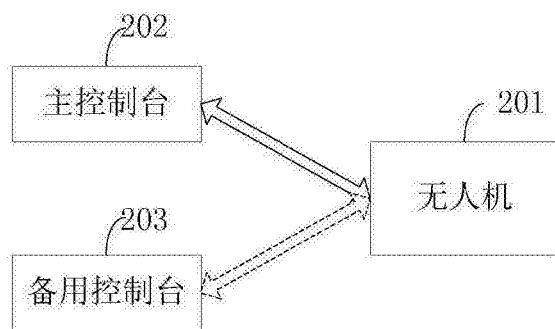


图 2

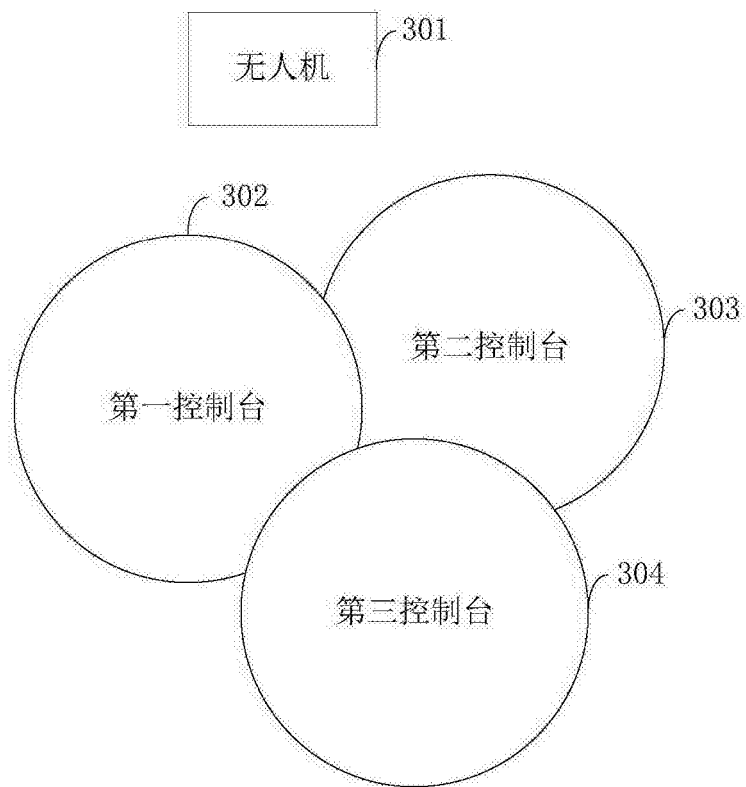


图 3

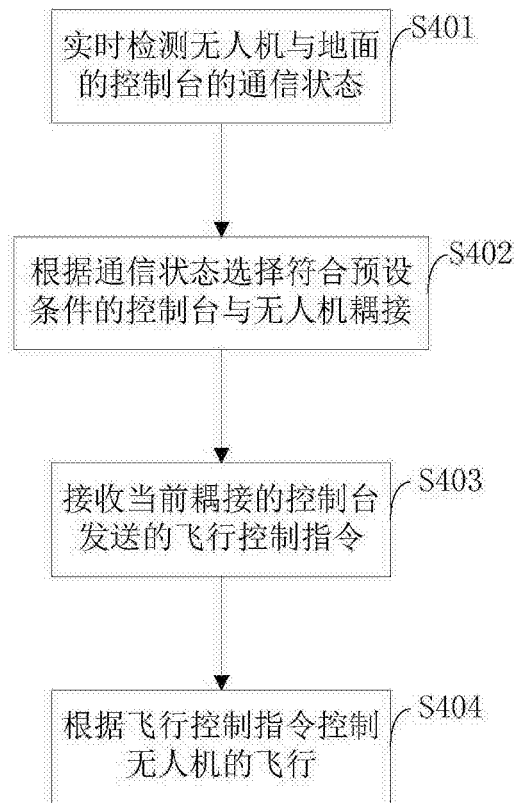


图 4