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(54) **UNMANNED AERIAL VEHICLE AND UNMANNED AERIAL VEHICLE CONTROLLING SYSTEM**

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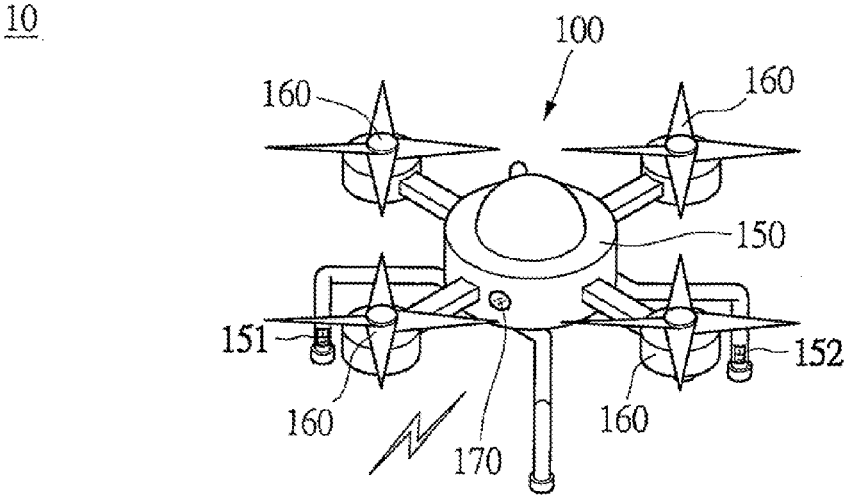
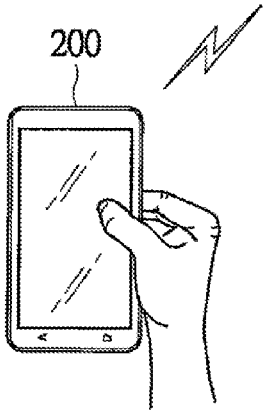
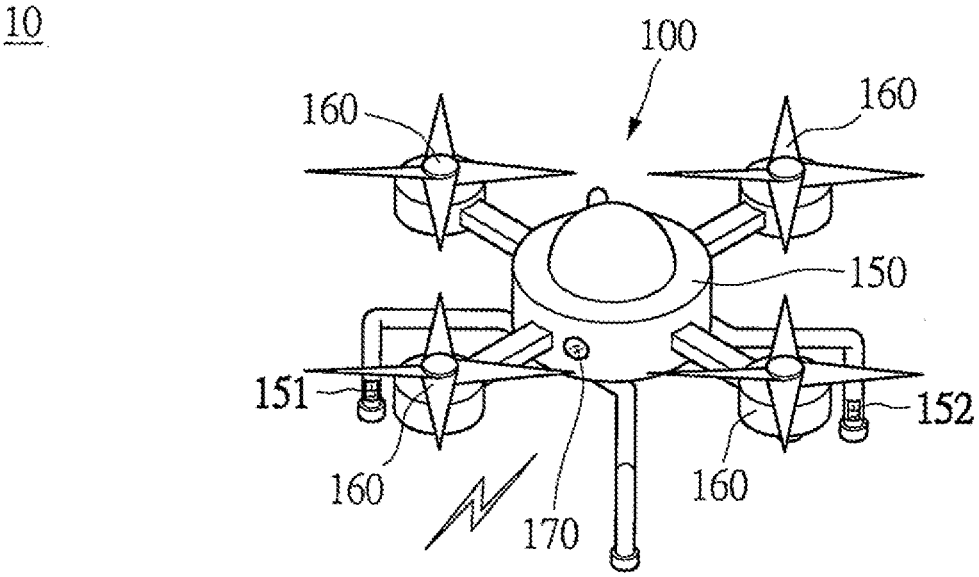
(57) **ABSTRACT**

The present invention provides an unmanned aerial vehicle and an unmanned aerial vehicle controlling system. The unmanned aerial vehicle controlling system includes the unmanned aerial vehicle and a controller. The unmanned aerial vehicle has a body, a first localization module and a second localization module. The first localization module and the second localization module are disposed on the body respectively facing a first direction and a second direction. The controller is used for sending a localization signal to the first localization module and a second localization module. The unmanned aerial vehicle controls the direction that the body faces and the distance between the unmanned aerial vehicle and the controller.







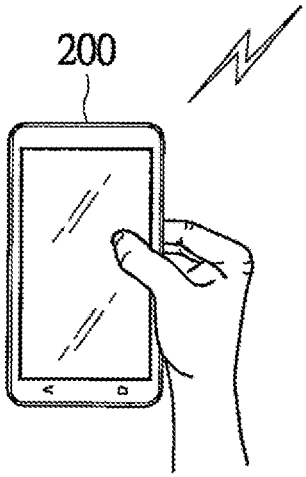


FIG. 1A

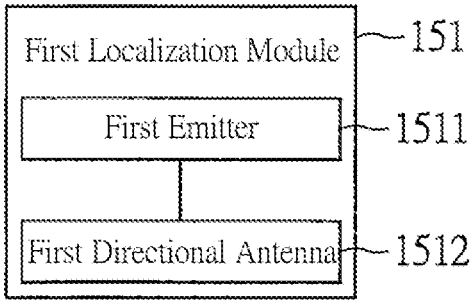

First Localization Module
151
First Emitter
1511
First Directional Antenna
1512

FIG. 1B

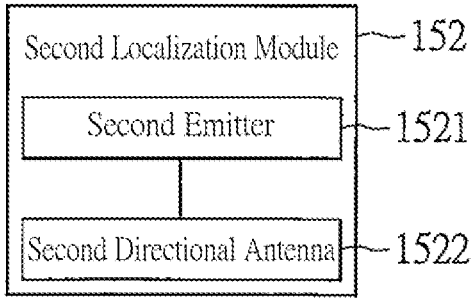

Second Localization Module
152
Second Emitter
1521
Second Directional Antenna
1522

FIG. 1C

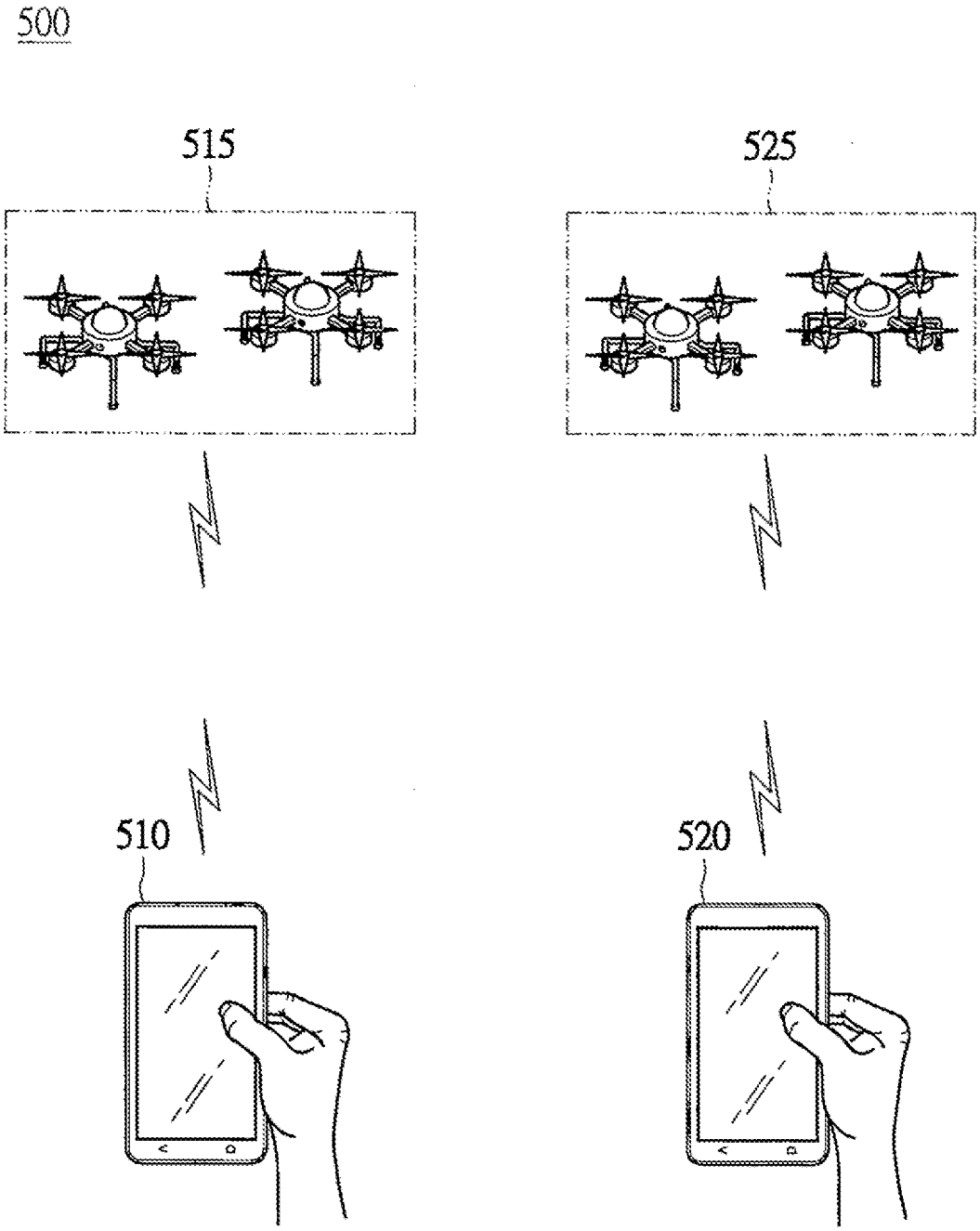


FIG. 1D

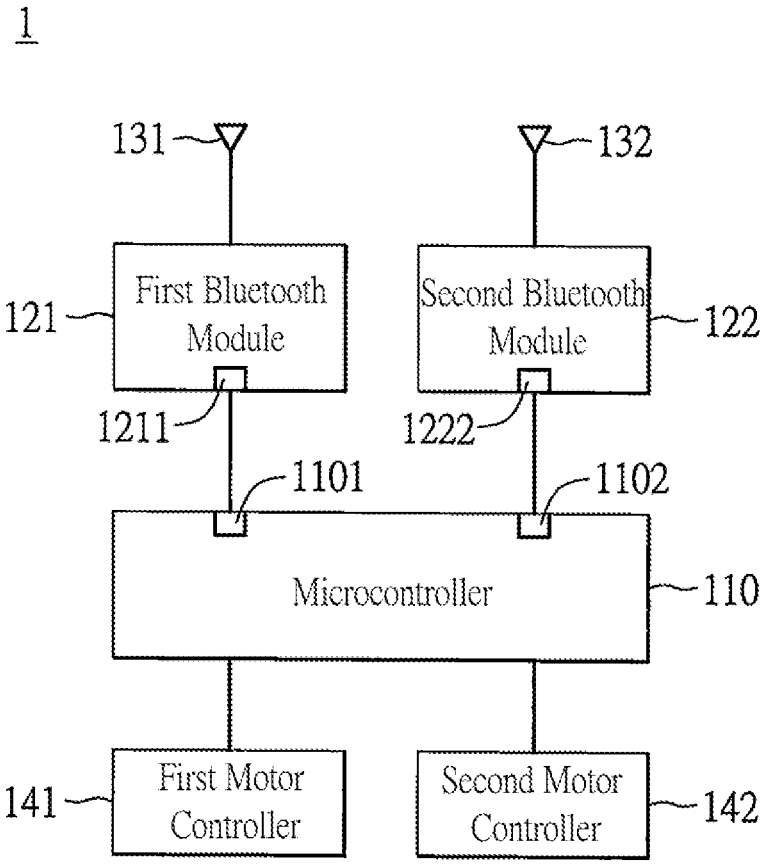

1
131
132
First Bluetooth Module
Second Bluetooth Module
121
122
1211
1222
1101
1102
Microcontroller
110
First Motor Controller
Second Motor Controller
141
142

FIG. 2A

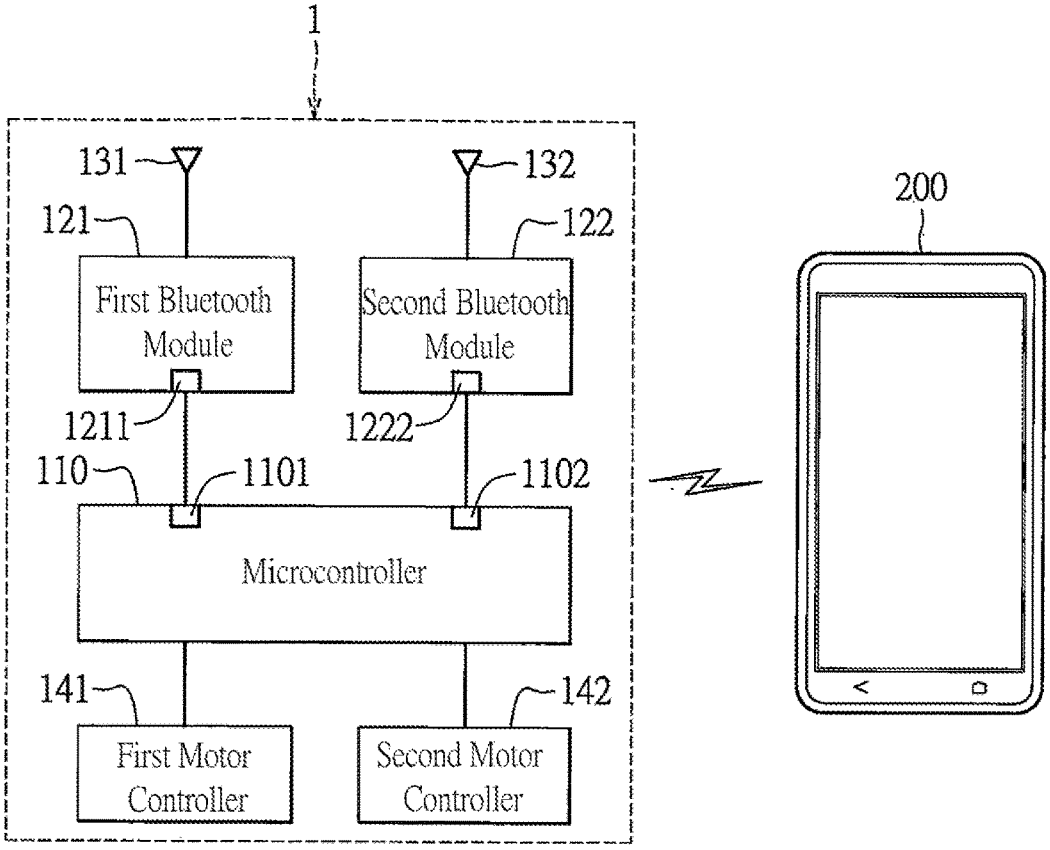

1
131
132
121
122
First Bluetooth Module
Second Bluetooth Module
1211
1222
110
1101
1102
Microcontroller
141
142
First Motor Controller
Second Motor Controller
200

FIG. 2B

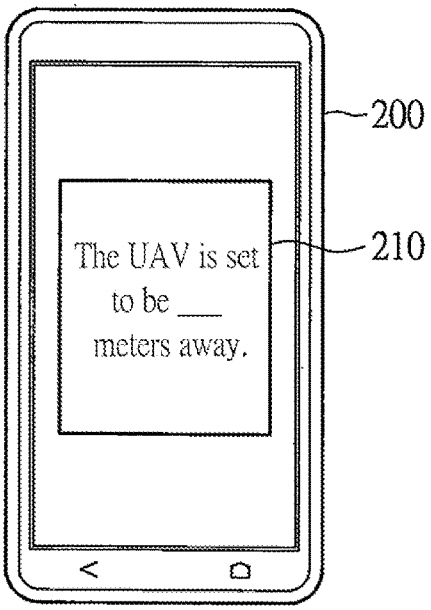

200
The UAV is set to be ___ meters away.
210

FIG. 2C

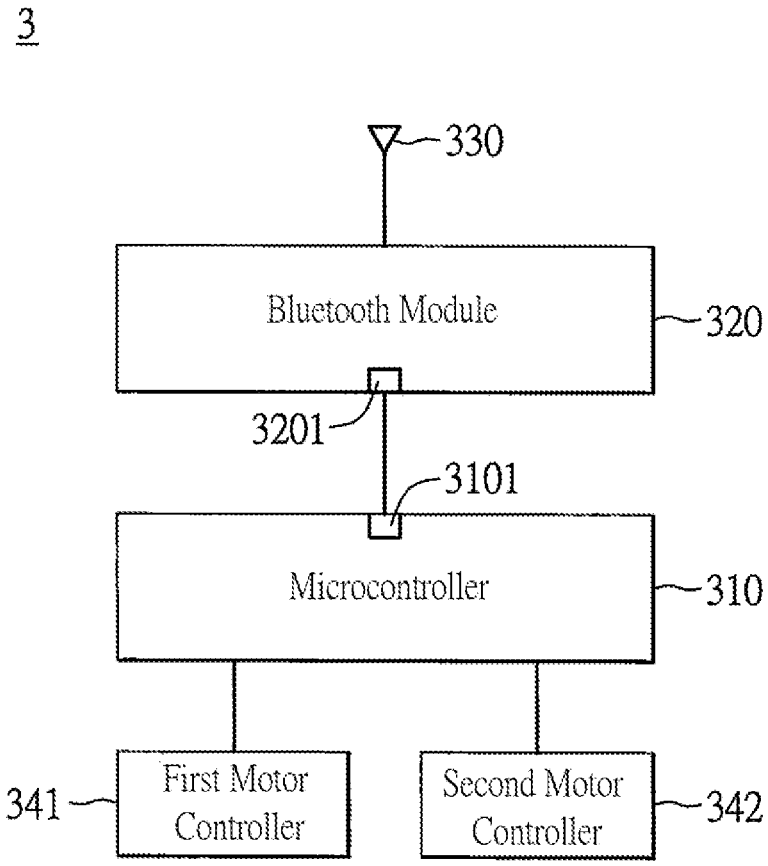
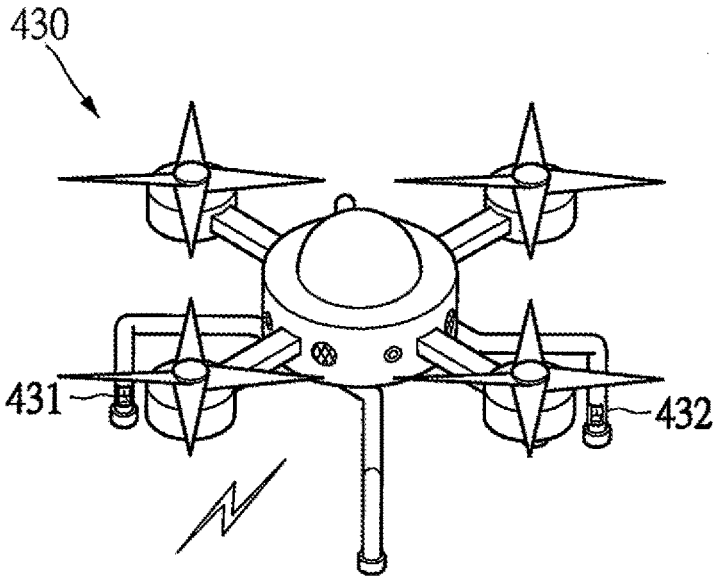

3
330
Bluetooth Module
320
3201
3101
Microcontroller
310
341
First Motor Controller
Second Motor Controller
342

FIG. 3



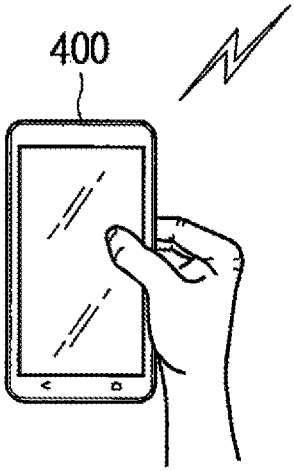


FIG. 4

UNMANNED AERIAL VEHICLE AND UNMANNED AERIAL VEHICLE CONTROLLING SYSTEM

FIELD OF THE INVENTION

[0001] The present invention relates to a control system, and specifically to an unmanned aerial vehicle and an unmanned aerial vehicle controlling system applicable to the tracking of a controller.

BACKGROUND OF THE INVENTION

[0002] Unmanned aerial vehicles (UAVs) are often used to gauge weather and take landscape shots or group photos. Generally speaking, the flight direction of a UAV is controlled by the user so that a better scene, scenery or portraits can be taken. A solution in the prior art is proposed where images are taken for the purpose of controlling the flight direction so as to take the image of a target. However, since controlling the flight direction through images recognition costs a large amount of calculation resources, and thus conventional ways of controlling the flight direction of a UAV does not work efficiently.

SUMMARY OF THE INVENTION

[0003] An objective of the present invention is to provide an unmanned aerial vehicle and an unmanned aerial vehicle controlling system that utilize the localization module disposed on the unmanned aerial vehicle to receive the localization signal sent by a controller, thereby controlling the flight direction and flying distance of the unmanned aerial vehicle through a microcontroller.

[0004] An embodiment of the present invention provides an unmanned aerial vehicle controlling system including an unmanned aerial vehicle and a controller. The unmanned aerial vehicle has a body, a first localization module and a second localization module, in which the first localization module and the second localization module are disposed on the body with the first localization module facing a first direction and the second localization module facing a second direction. The controller is used for sending a localization signal to the first localization module and the second localization module, in which the unmanned aerial vehicle controls the direction that the body faces and the distance between unmanned aerial vehicle and the controller according to the localization signal.

[0005] Another embodiment of the present invention provides an unmanned aerial vehicle controlling system having an unmanned aerial vehicle and a controller. The unmanned aerial vehicle has a body, a first localization module and a second localization module, in which the first localization module and the second localization module are disposed on the body with the first localization module facing a first direction and the second localization module facing a second direction. The controller is used for receiving a first emission signal sent from the first localization module and a second emission signal sent from the second localization module, in which the controller controls the direction that the body faces and the distance between unmanned aerial vehicle and the controller according to the localization information of the first emission signal and the localization information of the second emission signal.

[0006] Another embodiment of the present invention provides an unmanned aerial vehicle including a body, a first localization module, and a second localization module. The body has a plurality of rotors, a rotor controlling module and an image capturing device. The first localization module has a first directional antenna disposed on the body and facing a first direction. The first localization module is used for sending a first emission signal. The second localization module has a second directional antenna disposed on the body and facing a second direction, the second localization module being used for sending a second emission signal.

[0007] Another embodiment of the present invention provides an unmanned aerial vehicle controlling system including an unmanned aerial vehicle and a controller. The unmanned aerial vehicle has a body, a first localization module and a second localization module, in which the first localization module and the second localization module are disposed on the body with the first localization module facing a first direction and the second localization module facing a second direction. The controller is used for receiving a first emission signal sent from the first localization module and a second emission signal sent from the second localization module, in which the controller sends a localization information data according to the localization information of the first emission signal and the localization information of the second emission signal, and the unmanned aerial vehicle receives the localization information data and adjusts the direction that the body faces and the distance between unmanned aerial vehicle and the controller according to the localization information data.

[0008] Another embodiment of the present invention provides an unmanned aerial vehicle controlling system applicable to the tracking of a controller and the controlling of the flight direction and the flying distance of the unmanned aerial vehicle as stated above. The unmanned aerial vehicle controlling system includes a microcontroller, a plurality of directional antennae and a plurality of motor controllers. The plurality of directional antennae has a first directional antenna and a second directional antenna respectively coupled to the microcontroller, in which the first directional antenna receives a first receiving signal sent from the controller, the second directional antenna receives a second receiving signal sent from the controller, and the first receiving signal and the second receiving signal each have an identification code different from one another, wherein the microcontroller identifies the first receiving signal and the second receiving signal through the identification code thereof. The plurality of motor controllers includes a first motor controller and a second motor controller respectively coupled to the microcontroller. The microcontroller controls the flight direction and the flying distance of the unmanned aerial vehicle through the first motor controller and the second motor controller according to the first receiving signal and the second receiving signal such that the distance between the unmanned aerial vehicle and the controller is a predetermined distance.

[0009] Another embodiment of the present invention provides an unmanned aerial vehicle controlling system applicable to the controlling of the flight direction and the flying distance of the unmanned aerial vehicle as stated above. The unmanned aerial vehicle controlling system includes a microcontroller, a plurality of directional antennae, a plurality of motor controllers and a controller. The plurality of directional antennae includes a first directional antenna and a second directional antenna respectively coupled to the microcontroller, in which the first directional antenna

receives a first receiving signal sent from the controller, the second directional antenna receives a second receiving signal sent from the controller, and the first receiving signal and the second receiving signal each have an identification code different from one another, wherein the microcontroller identifies the first receiving signal and the second receiving signal through the identification code thereof. The plurality of motor controllers includes a first motor controller and a second motor controller respectively coupled to the microcontroller. The controller is wirelessly connected to the unmanned aerial vehicle controlling system and has a user interface. The controller is used for controlling that the distance between the unmanned aerial vehicle and the controller is a predetermined distance. The microcontroller controls the flight direction and the flying distance of the unmanned aerial vehicle through the first motor controller and the second motor controller according to the first receiving signal and the second receiving signal such that the distance between the unmanned aerial vehicle and the controller is a predetermined distance.

[0010] Another embodiment of the present invention includes an unmanned aerial vehicle controlling system applicable to the tracking of a controller and the controlling of the flight direction and the flying distance of the unmanned aerial vehicle as stated above. The unmanned aerial vehicle controlling system includes a microcontroller, a directional antenna, and a plurality of motor controllers. The directional antenna is coupled to the microcontroller and receiving a localization signal sent from the controller. The plurality of motor controllers includes a first motor controller and a second motor controller respectively coupled to the microcontroller. The microcontroller controls the flight direction and the flying distance of the unmanned aerial vehicle through the first motor controller and the second motor controller according to the localization signal such that the distance between the unmanned aerial vehicle and the controller is a predetermined distance.

[0011] With the aforementioned technical solutions, the unmanned aerial vehicle controlling system of the present invention includes the body, the first localization module and the second localization module of the unmanned aerial vehicle, in which the first localization module and the second localization module can be disposed facing different directions such that the controller can receive difference localization signals. The controller then controls the direction that the body faces and the distance between the unmanned aerial vehicle and the controller according to the localization signal sent from the first localization module and that sent from the second localization module, thereby achieving the tracking of the controller performed by the unmanned aerial vehicle with high accuracy.

[0012] Furthermore, the present invention utilizes the first directional antenna and the second directional antenna to receive the first receiving signal and the second receiving signal. The microcontroller determines whether to use the first motor controller and the second motor controller to change the flight direction and/or the flying distance according to the difference between the first receiving signal and the second receiving signal. In this way, the present invention can effectively reduce the manufacturing costs and enhance the spontaneity of the tracking performed by the unmanned aerial vehicle.

[0013] To further learn the features and technical content of the present invention, please refer to the following detailed descriptions and drawings related to the present invention. However, the provided drawings are used only for providing reference and descriptions, and are not intended to limit the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] FIG. **1**A is a schematic view showing an unmanned aerial vehicle controlling system in operation according to one embodiment of the present invention.

[0015] FIG. **1**B is a block diagram showing the first localization module according to one embodiment of the present invention.

[0016] FIG. **1**C is a block diagram showing the second localization module according to one embodiment of the present invention.

[0017] FIG. **1**D is a schematic view showing an unmanned aerial vehicle controlling system in operation according to one embodiment of the present invention.

[0018] FIG. **2**A is a schematic view showing the structure of an unmanned aerial vehicle controlling system according to one embodiment of the present invention.

[0019] FIG. **2**B is a schematic view showing the structure of an unmanned aerial vehicle controlling system according to another embodiment of the present invention.

[0020] FIG. **2**C illustrates a user interface of the controller according to one embodiment of the present invention.

[0021] FIG. **3** is a schematic view showing the structure of an unmanned aerial vehicle controlling system according to another embodiment of the present invention.

[0022] FIG. **4** is a schematic view showing an unmanned aerial vehicle controlling system in operation according to another embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0023] Please refer to FIGS. **1**A, **1**B, and **1**C, in which FIG. **1**A is a schematic view showing an unmanned aerial vehicle controlling system in operation according to one embodiment of the present invention, FIG. **1**B is a block diagram showing the first localization module according to one embodiment of the present invention, and FIG. **1**C is a block diagram showing the second localization module according to one embodiment of the present invention.

[0024] The unmanned aerial vehicle controlling system **10** includes an unmanned aerial vehicle **100** and a controller **200**. The unmanned aerial vehicle **100** can be wirelessly controlled in Wi-Fi mode or in Bluetooth mode. In the present embodiment, the controller **200** is exemplified as a smartphone; however, the present invention is not limited thereto. The unmanned aerial vehicle **100** includes the body **150**, the first localization module **151**, the second localization module **152**, a plurality of rotors **160** and the image capturing device **170**. The first localization module **151** includes the first emitter **1511** and the first directional antenna **1512**. The first directional antenna **1512** is coupled to the first emitter **1511**. The second localization module **152** includes the second emitter **1521** and the second directional antenna **1522**. The second directional antenna **1522** is coupled to the second emitter **1521**. It is commonly known that a localization module can emit and receive signals wirelessly, and thus details of the localization modules will not be further described herein.

[0025] Specifically, the first localization module **151**, the second localization module **152**, the rotors **160** and the image capturing device **170** are disposed on the body **150**. The first directional antenna **1512** of the first localization module **151** is disposed facing the first direction. It should be understood that a signal sent from a directional antenna typically has at least one main lobe and at plurality of side lobes, in which the main lobes emit stronger radiation than the side lobes do. In addition, the first emission signal includes a first identification code, and the second emission signal includes a second identification code different from the first identification code. The controller **200** compares the localization information of the first emission signal and that of the second emission signal. The first localization module **151** sends a plurality of the first emission signals with a time interval between each successive first emission signal. The second localization module **152** sends a plurality of the second emission signals with the time interval of the first localization module **151** between each successive second emission signal. The time interval can be 1 ms, 5 ms, or 10 ms; however, the present invention is not limited thereto.

[0026] The main lobe of the first localization module **151** and that of the second localization module **152** face different directions. The controller **200** can receive the first emission signal sent from the first localization module **151** of the unmanned aerial vehicle **100**, and can receive the second emission signal sent from the second localization module **152** of the unmanned aerial vehicle **100**. Furthermore, the controller **200** can determine the intensity of the first emission signal and that of the second emission signal through the information thereof. In other words, the controller **200** controls the direction that the body **150** faces and the distance between the unmanned aerial vehicle **100** and the controller **200** according to the localization information of the first emission signal and that of the second emission signal.

[0027] Please refer to FIG. **1**A. The direction faced by the image capturing device **170** on the body **150** can be changed in accordance with the change in the direction of the body **150** such that the image capturing device **170** faces the controller **200**. Specifically, the unmanned aerial vehicle controlling system **10** of the present invention can automatically track the controller **200**, in which the controller **200** can control the direction of the image capturing device **170** according to the localization information of the first emission signal sent by the first localization module **151** and that of the second emission signal sent by the second localization module **152** such that the image capturing device **170** faces the controller **200**.

[0028] The unmanned aerial vehicle **100** includes a plurality of rotors **160** and a rotor controlling module (not shown in the drawings). The rotor controlling module controls the plurality of rotors **160** in accordance with the control signal sent from the controller **200** such that the flight direction and the flying distance of the body **150** of the unmanned aerial vehicle **100** can be controlled. For example, the controller **200** generates localization information data by comparing the localization information of the first emission signal and that of the second emission signal. Furthermore, the controller **200** sends the localization information data, and the unmanned aerial vehicle **100** receives the localization information data and adjusts the direction that the body **150** faces and the distance between the unmanned aerial vehicle **100** and the controller **200** according to the localization information data.

[0029] In one embodiment, the unmanned aerial vehicle controlling system **10** includes the unmanned aerial vehicle **100** and the controller **200**. Specifically, the unmanned aerial vehicle **100** has the body **150**, the first localization module **151**, and the second localization module **152**. The first localization module **151** and the second localization module **152** are disposed on the body **150** and face a first direction and a second direction respectively. The controller **200** is used for sending a localization signal to the first localization module **151** and the second localization module **152**, and then the microcontroller (not shown in the drawings) in the unmanned aerial vehicle **100** controls the direction of the body **150** and the distance between the unmanned aerial vehicle **100** and the controller **200**. The unmanned aerial vehicle controlling system **10** adjusts the image capturing device **170** so that the image capturing device **170** faces the controller **200**, which enables the image capturing device **170** to capture a desired image, e.g. the whole image of a certain target.

[0030] Referring to FIG. **1**D, which shows a schematic view showing an unmanned aerial vehicle controlling system in operation according to one embodiment of the present invention, the unmanned aerial vehicle controlling system **500** includes a plurality of unmanned aerial vehicles and a plurality of controllers. The plurality of controllers includes at least a first controller **510** and a second controller **520**. The plurality of unmanned aerial vehicles includes at least a first group of unmanned aerial vehicles **515** and a second group of unmanned aerial vehicles **525**. Details regarding the unmanned aerial vehicle and the controller can be found in the description of the embodiment shown in FIG. **1**A, and therefore will not be further described herein.

[0031] The first controller **510** is used for sending a first localization signal to the group of unmanned aerial vehicles **515** and controlling the direction of the body and the distance between the first group of the unmanned aerial vehicles **515** and the first controller **510**. In other words, the first controller **510** can control all the unmanned aerial vehicles of the first group of unmanned aerial vehicles **510** at the same time. In the present embodiment, the first controller **510** can control the two unmanned aerial vehicles in the first group of unmanned aerial vehicles **510** at the same time, and in another embodiment, the first controller **510** can control a plurality of unmanned aerial vehicles in the first group of unmanned aerial vehicles **515**. The second controller **520** is used for sending a second localization signal and controlling the direction of the body and the distance between the second group of unmanned aerial vehicles **525** and the second controller **520**. It should be noted that the present invention is not limited to the number of the unmanned aerial vehicles and the controllers.

[0032] Please refer to FIG. **2**A, which is a schematic view showing the structure of an unmanned aerial vehicle controlling system according to one embodiment of the present invention. The present embodiment provides an unmanned aerial vehicle controlling system **1** applicable to the tracking of a controller (not shown in the drawings) and the controlling of the flight direction and the flying distance of the unmanned aerial vehicle (not shown in the drawings). Furthermore, the unmanned aerial vehicle controlling system **1** can track the direction and travelled distance of the controller.

[0033] Referring to FIG. **2**A, the unmanned aerial vehicle controlling system **1** includes the microcontroller **110**, the first Bluetooth module **121**, the second Bluetooth module **122**, the first directional antenna **131**, the second directional antenna **132**, the first motor controller **141**, and the first motor controller **141**. The microcontroller **110** further includes the third serial peripheral interface **1101** and the fourth serial peripheral interface **1102**. The first Bluetooth module **121** includes the first serial peripheral interface **1211**, and the second Bluetooth module **122** includes the second serial peripheral interface **1222**.

[0034] The microcontroller (MCU) **110** can include software, firmware and hardware that enable the microcontroller **110** to complete proper calculation so as to control the flight direction and flying distance of the unmanned aerial vehicle. For instance, when the unmanned aerial vehicle is too far away from the user taking hold of the controller, the microcontroller **110** controls the unmanned aerial vehicle to fly towards the user. On the contrary, when the unmanned aerial vehicle is too close to the user taking hold of the controller, the microcontroller **110** controls the unmanned aerial vehicle to fly away from the user.

[0035] In the present embodiment, the unmanned aerial vehicle controlling system **1** includes a plurality of directional antennae. Specifically, in this embodiment, the unmanned aerial vehicle controlling system **1** includes a first directional antenna **131** and a second directional antenna **132**. The first directional antenna **131** sends a first emission signal to the controller, which calculates the first receiving signal according to the first emission signal. The second directional antenna **132** sends a second emission signal to the controller, which calculates the second receiving signal according to the second emission signal. The microcontroller **110** controls the flight direction and the flying distance of the unmanned aerial vehicle according to the difference between the first receiving signal and the second receiving signal. For example, if the information of the second emission signal sent by the second directional antenna **132** is sequenced prior to the information of the first emission signal sent by the first directional antenna **131**, the controller determines by calculation that the signal intensity of the second receiving signal is stronger than that of the first receiving signal.

[0036] To be specific, a directional antenna is designed to emit and receive electromagnetic waves in one or more particular directions, along which the main lobes have stronger field strength. The directional antenna emits and receives weaker electromagnetic waves in other directions, where the side lobes reside. If a circular polarization antenna is used, polarization mismatch may occur when the controller is being moved. Therefore, in the present embodiment, the first emission signal sent by the first directional antenna **131** and the second emission signal sent by the second directional antenna **132** can avoid polarization mismatch during the displacement of the controller.

[0037] The first directional antenna **131** and the second directional antenna **132** are coupled to the microcontroller **110** through the first Bluetooth module **121** and the second Bluetooth module **122** respectively. The first directional antenna **131** receives the first receiving signal sent from the controller, and the second directional antenna **132** receives the second receiving signal sent form the controller, wherein the first receiving signal and the second receiving signal each have an identification code different from one another. The microcontroller **110** identifies the first receiving signal and second receiving signal through the identification codes thereof.

[0038] In the present embodiment, the unmanned aerial vehicle controlling system **1** has a plurality of motor controllers. Specifically, the unmanned aerial vehicle controlling system **1** includes the first motor controller **141** and the second motor controller **142** respectively coupled to the microcontroller **110**. Furthermore, the first motor controller **141** is used for controlling the flight direction of the unmanned aerial vehicle, and the second motor controller **142** is used for controlling the flying distance of the unmanned aerial vehicle. The microcontroller **110** controls the unmanned aerial vehicle to rotate and change the flight direction thereof, or control the unmanned aerial vehicle to fly close to or away from the controller through the first motor controller **141** and the second motor controller **142**.

[0039] Specifically, when the microcontroller **110** determines that the localization information of the first receiving signal is not equal to that of the second receiving signal, it may be the case that the information transmitted between the first directional antenna **131** and the controller is different from that transmitted between the second directional antenna **132** and the controller. Accordingly, the microcontroller **110** controls the first motor controller **141** to rotate the flight direction of the unmanned aerial vehicle in a manner such that the localization information of the first receiving signal is essentially equal to that of the second receiving signal.

[0040] On the other hand, when the microcontroller **110** determines that the localization information of the first receiving signal and that of the second receiving signal are identical and both smaller than a first distance-localization signal intensity, the microcontroller **110** controls the second motor controller **142** such that the unmanned aerial vehicle flies a flying distance towards the controller until the distance therebetween is equal to a predetermined distance. When the microcontroller **110** determines that the localization information of the first receiving signal and that of the second receiving signal are identical and both larger than a second distance-localization signal intensity, the microcontroller **110** controls the second motor controller **142** such that the unmanned aerial vehicle flies a flying distance away from the controller until the distance therebetween is equal to the predetermined distance. Specifically, the second distance-localization signal intensity is larger than the first distance-localization signal intensity. For instance, when the microcontroller **110** determines that the unmanned aerial vehicle is too far away from the controller, the microcontroller **110** controls the second motor controller **142** such that the unmanned aerial vehicle flies towards the controller until the distance therebetween is the predetermined distance. On the other hand, when the microcontroller **110** determines that the unmanned aerial vehicle is too close to the controller, the microcontroller **110** controls the second motor controller **142** such that the unmanned aerial vehicle flies away from the controller until the distance therebetween is the predetermined distance.

[0041] In the present embodiment, the unmanned aerial vehicle controlling system **1** has a plurality of Bluetooth modules. Specifically, the unmanned aerial vehicle controlling system **1** includes the first Bluetooth module **121** and the second Bluetooth module **122**. The first Bluetooth module **121** has the first serial peripheral interface (SPI) **1211**,

and the second Bluetooth module **122** has the second serial peripheral interface **1222**. The first serial peripheral interface **1211** of the first Bluetooth module **121** is coupled between the first directional antenna **131** and the third serial peripheral interface **1101** of the microcontroller **110**. The second serial peripheral interface **1222** of the microcontroller **110** is coupled between the second directional antenna **132** and the fourth serial peripheral interface **1102** of the microcontroller **110**. Both the first Bluetooth module **121** and the second Bluetooth module **122** include storage circuits. The first Bluetooth module **121** receives the first receiving signal from the first directional antenna **131**, and the second Bluetooth module **122** receives the second receiving signal from the second directional antenna **132**. In one embodiment, a switch (not shown in the drawings) is provided between the first Bluetooth module **121** and the first directional antenna **131** and between the second Bluetooth module **122** and the second directional antenna **132** such that the first directional antenna **131** can be coupled to the second Bluetooth module **122**, and the second directional antenna **132** can be coupled to the first Bluetooth module **121**.

[0042] It can be derived from the above that the microcontroller **110** controls the flight direction and the flying distance of the unmanned aerial vehicle through the first motor controller **141** and the second motor controller **142** according to the first receiving signal and the second receiving signal in a manner such that the distance between the unmanned aerial vehicle and the controller held by the user is equal to the predetermined distance.

[0043] Please refer to FIG. **2**B and FIG. **2**C, in which FIG. **2**B is a schematic view showing the structure of an unmanned aerial vehicle controlling system according to another embodiment of the present invention, and FIG. **2**C illustrates a user interface of the controller according to one embodiment of the present invention. FIG. **2**B shows the unmanned aerial vehicle controlling system **1** and the controller **200**. For details about the unmanned aerial vehicle controlling system **1**, one can refer to the description of the embodiment shown in FIG. **2**A, and therefore the details about the unmanned aerial vehicle controlling system **1** will not be further described herein. The controller **200** can be wirelessly connected to the unmanned aerial vehicle controlling system **1** in Bluetooth mode or in Wi-Fi mode. The controller **200** includes a user interface **210** for receiving commands specifying the distance between the unmanned aerial vehicle and the controller **200**.

[0044] Referring to FIG. **3**, which is a schematic view showing the structure of an unmanned aerial vehicle controlling system according to another embodiment of the present invention, the unmanned aerial vehicle controlling system **3** includes the microcontroller **310**, the Bluetooth module **320**, the directional antenna **330**, the first motor controller **341**, and the second motor controller **342**. The microcontroller **310** includes the serial peripheral interface **3101**. The Bluetooth module **320** includes the serial peripheral interface **3201**. The serial peripheral interface **3101** of the microcontroller **310** is coupled to the serial peripheral interface **3201** of the Bluetooth module **320**. The directional antenna **330** is coupled to the microcontroller **310** via the Bluetooth module **320** and receives the receiving signal sent from the controller. In the present embodiment, the unmanned aerial vehicle controlling system **3** includes a plurality of motor controllers. Specifically, the unmanned aerial vehicle controlling system **3** includes at least the first motor controller **341** and the second motor controller **342** respectively coupled to the microcontroller **310**.

[0045] Furthermore, the first motor controller **341** is used for controlling the flight direction of the unmanned aerial vehicle, and the second motor controller **342** is used for controlling the flying distance of the unmanned aerial vehicle. When the microcontroller **310** determines that the intensity of the localization signal is smaller than the direction-localization signal intensity, which indicates that the main lobe received by the controller is shifted in a significant manner, the microcontroller **310** controls the first motor controller **341** to rotate the unmanned aerial vehicle such that the flight direction thereof is changed. When the microcontroller **310** determines that the intensity of the localization signal is smaller than the distance-localization signal intensity, the microcontroller **310** controls the second motor controller **342** such that the unmanned aerial vehicle flies towards the controller until the distance therebetween is the predetermined distance. When the microcontroller **310** determines that the intensity of the localization signal is larger than the distance-localization signal intensity, the microcontroller **310** controls the second motor controller **342** such that the unmanned aerial vehicle flies away from the controller until the distance therebetween is the predetermined distance. The microcontroller **310** controls the flight direction and the flying distance of the unmanned aerial vehicle through the first motor controller **341** and the second motor controller **342** according to the localization signal such that the distance between the unmanned aerial vehicle and the controller held by the user is the predetermined distance.

[0046] Please refer to FIG. **4**, which is a schematic view showing an unmanned aerial vehicle controlling system in operation according to another embodiment of the present invention. The unmanned aerial vehicle **430** includes the first directional antenna **431** and the second directional antenna **432**. The controller **400** can calculate the first receiving signal and the second receiving signal according to the first emission signal sent form the first directional antenna **431** and the second emission signal sent from the second directional antenna **432**. The microcontroller (not shown in the drawings) of the unmanned aerial vehicle **430** can control the flight direction and the flying distance of the unmanned aerial vehicle **430** according to the difference between the first receiving signal and the second receiving signal.

[0047] In summary, the unmanned aerial vehicle and the unmanned aerial vehicle controlling system provided by the present invention include the body, the first localization module and the second localization module of the unmanned aerial vehicle, in which the first localization module and the second localization module are disposed facing different directions such that the controller receives different localization signals. The controller then controls the direction that the body faces and the distance between the unmanned aerial vehicle and the controller according to localization signal sent form the first localization module and that sent from the second localization module, thereby achieving accurate tracking of the controller performed by the unmanned aerial vehicle.

[0048] Furthermore, the present invention utilizes the first directional antenna and the second directional antenna to receive the first receiving signal and the second receiving

signal respectively, in which the microcontroller determines the difference between the first receiving signal and the second receiving signal to decide whether to change the flight direction and the flying distance of the unmanned aerial vehicle through the first motor controller and the second motor controller. In addition, the first receiving signal and the second receiving signal each have an identification code different from each other so that the microcontroller can distinguish the first receiving signal from the second receiving signal, thereby enhancing the communication between the first directional antenna, the second directional antenna and the controller. The present invention controls the unmanned aerial vehicle to track the controller held by a user by calculating the intensity difference between the localization signals so that the distance between the unmanned aerial vehicle and the controller is essentially equal to a predetermined distance, thereby effectively enhancing the spontaneity of the tacking and lowering the manufacturing costs. In addition, the first emission signal sent by the first directional antenna and the second emission signal sent by the second directional antenna can avoid polarization mismatch which may occur when the controller is being moved.

[0049] The present invention has been described with reference to the above embodiments, but the above embodiments are merely examples for implementing the present invention. It should be noted that the disclosed embodiments are not intended to limit the scope of the present invention. On the contrary, any modification and equivalent configuration within the spirit and scope of the appended claims shall fall within the scope of the present invention.

What is claimed is:

1. An unmanned aerial vehicle controlling system, comprising:

an unmanned aerial vehicle having a body, a first localization module and a second localization module, in which the first localization module and the second localization module are disposed on the body with the first localization module facing a first direction and the second localization module facing a second direction; and

a controller for sending a localization signal to the first localization module and the second localization module, in which the unmanned aerial vehicle controls the direction that the body faces and the distance between unmanned aerial vehicle and the controller according to the localization signal.

2. The unmanned aerial vehicle controlling system according to claim **1**, wherein the controller includes a first controller and a second controller, the unmanned aerial vehicle further comprising:

a first group of unmanned aerial vehicles having a plurality of the unmanned aerial vehicles; and

a second group of unmanned aerial vehicles having a plurality of the unmanned aerial vehicles,

wherein the first controller is used for sending a first localization signal and controlling the direction that the first group of unmanned aerial vehicles face and the distance between the first group of unmanned aerial vehicles and the first controller,

wherein the second controller is used for sending a second localization signal and controlling the direction that the second group of unmanned aerial vehicles face and the distance between the second group of unmanned aerial vehicles and the second controller.

3. An unmanned aerial vehicle controlling system, comprising:

an unmanned aerial vehicle having a body, a first localization module and a second localization module, the first localization module and the second localization module being disposed on the body with the first localization module facing a first direction and the second localization module facing a second direction; and

a controller for receiving a first emission signal sent from the first localization module and a second emission signal sent from the second localization module, the controller controlling the direction that the body faces and the distance between unmanned aerial vehicle and the controller according to the localization information of the first emission signal and the localization information of the second emission signal.

4. The unmanned aerial vehicle controlling system according to claim **3**, wherein the first localization module includes:

a first emitter; and

a first directional antenna coupled to the first emitter.

5. The unmanned aerial vehicle controlling system according to claim **3**, wherein the first localization module includes:

a second emitter; and

a second directional antenna coupled to the second emitter.

6. The unmanned aerial vehicle controlling system according to claim **3**, wherein the first localization module faces the first direction and the second localization module faces the second direction in a manner such that the main lobe of the first localization module and that of the second localization module face different directions respectively.

7. The unmanned aerial vehicle controlling system according to claim **3**, wherein the unmanned aerial vehicle further includes an image capturing device disposed on the body, in which the direction faced by the image capturing device is changed in accordance with the change in the direction of the body such that the image capturing device faces the controller.

8. The unmanned aerial vehicle controlling system according to claim **3**, wherein the unmanned aerial vehicle includes a plurality of rotors and a rotor controlling module, the rotor controlling module controlling the plurality of rotors according to a control signal sent from the controller, in which the controller generates the control signal by comparing the localization information of the first emission signal and the localization information of the second emission signal.

9. The unmanned aerial vehicle controlling system according to claim **3**, wherein the first emission signal includes a first identification code, and the second emission signal includes a second identification code different from the first identification code.

10. The unmanned aerial vehicle controlling system according to claim **3**, wherein the first localization module sends a plurality of the first emission signals with a time interval between each successive first emission signal.

11. An unmanned aerial vehicle, comprising:

a body including a plurality of rotors, a rotor controlling module and an image capturing device;

a first localization module having a first directional antenna disposed on the body and facing a first direction, the first localization module being used for sending a first emission signal; and

a second localization module having a second directional antenna disposed on the body and facing a second direction, the second localization module being used for sending a second emission signal.

12. The unmanned aerial vehicle according to claim **11**, wherein the first localization module has a first emitter coupled to the first directional antenna, the first emitter generating signals including a first identification code, which are sent by the first directional antenna with a time interval between each successive said signal, and wherein the second localization module has a second emitter coupled to the second directional antenna, the second emitter generating signals including a second identification code, which are sent by the second directional antenna with the time interval between each successive said signal.

13. An unmanned aerial vehicle controlling system, comprising:

an unmanned aerial vehicle having a body, a first localization module and a second localization module, the first localization module and the second localization module being disposed on the body with the first localization module facing a first direction and the second localization module facing a second direction; and

a controller for receiving a first emission signal sent from the first localization module and a second emission signal sent from the second localization module, in which the controller sends a localization information data according to the localization information of the first emission signal and the localization information of the second emission signal, and the unmanned aerial vehicle receives the localization information data and adjusts the direction that the body faces and the distance between unmanned aerial vehicle and the controller according to the localization information data.

14. An unmanned aerial vehicle controlling system applicable to the tracking of a controller and the controlling of the flight direction and the flying distance of the unmanned aerial vehicle according to claim **11**, the unmanned aerial vehicle controlling system comprising:

a microcontroller;

a plurality of directional antennae including a first directional antenna and a second directional antenna respectively coupled to the microcontroller, in which the first directional antenna receives a first receiving signal sent from the controller, the second directional antenna receives a second receiving signal sent from the controller, and the first receiving signal and the second receiving signal each have an identification code different from one another, wherein the microcontroller identifies the first receiving signal and the second receiving signal through the identification code thereof; and

a plurality of motor controllers including a first motor controller and a second motor controller respectively coupled to the microcontroller,

wherein the microcontroller controls the flight direction and the flying distance of the unmanned aerial vehicle through the first motor controller and the second motor controller according to the first receiving signal and the second receiving signal such that the distance between the unmanned aerial vehicle and the controller is a predetermined distance.

15. The unmanned aerial vehicle controlling system according to claim **14**, wherein the first motor controller is used for controlling the flight direction of the unmanned aerial vehicle, and the second motor controller is used for controlling the flying distance of the unmanned aerial vehicle, wherein when the microcontroller determines that the localization information of the first receiving signal is not equal to that of the second receiving signal, the microcontroller controls the first motor controller to change the flight direction of the unmanned aerial vehicle, wherein when the microcontroller determines that the localization information of the first receiving signal and that of the second receiving signal are identical and both smaller than a first distance-localization signal intensity, the microcontroller controls the second motor controller such that the unmanned aerial vehicle flies a flying distance towards the controller until the distance therebetween is the predetermined distance, and wherein when the microcontroller determines that the localization information of the first receiving signal and that of the second receiving signal are identical and both larger than a second distance-localization signal intensity, the microcontroller controls the second motor controller such that the unmanned aerial vehicle flies a flying distance away from the controller until the distance therebetween is the predetermined distance.

16. The unmanned aerial vehicle controlling system according to claim **14**, further comprising:

a plurality of Bluetooth module including a first Bluetooth module having a first serial connection interface and a second Bluetooth module having a second serial connection interface, the first serial connection interface of the first Bluetooth module being coupled between the first directional antenna and a third serial connection interface of the microcontroller, the second serial connection interface of the second Bluetooth module being coupled between the second directional antenna a fourth serial connection interface of the microcontroller, wherein the first Bluetooth module receives the first receiving signal through the first directional antenna and stores the first receiving signal, and wherein the second Bluetooth module receives the second receiving signal through the second directional antenna and stores the second receiving signal.

17. The unmanned aerial vehicle controlling system according to claim **14**, wherein the first directional antenna sends a first emission signal to the controller, and the controller calculates the first receiving signal according to the first emission signal; the second directional antenna sends a second emission signal to the controller, and the controller calculates the second receiving signal according to the second emission signal; the microcontroller controls the flight direction and the flying distance of the unmanned aerial vehicle in accordance with the difference between the first receiving signal and the second receiving signal.

18. An unmanned aerial vehicle controlling system applicable to the controlling of the flight direction and the flying distance of the unmanned aerial vehicle according to claim **11**, the unmanned aerial vehicle controlling system comprising:

a microcontroller;

a plurality of directional antennae, including a first directional antenna and a second directional antenna respectively coupled to the microcontroller, in which the first directional antenna receives a first receiving signal sent from the controller, the second directional antenna receives a second receiving signal sent from the controller, and the first receiving signal and the second receiving signal each have an identification code different from one another, wherein the microcontroller identifies the first receiving signal and the second receiving signal through the identification codes thereof;

a plurality of motor controllers including a first motor controller and a second motor controller respectively coupled to the microcontroller; and

a controller wirelessly connected to the unmanned aerial vehicle controlling system and having a user interface, the controller being used for controlling that the distance between the unmanned aerial vehicle and the controller is a predetermined distance,

wherein the microcontroller controls the flight direction and the flying distance of the unmanned aerial vehicle through the first motor controller and the second motor controller according to the first receiving signal and the second receiving signal such that the distance between the unmanned aerial vehicle and the controller is a predetermined distance.

19. The unmanned aerial vehicle controlling system according to claim **18**, wherein the first motor controller is used for controlling the flight direction of the unmanned aerial vehicle, and the second motor controller is used for controlling the flying distance of the unmanned aerial vehicle, wherein when the microcontroller determines that the first receiving signal is not equal to the second receiving signal, the microcontroller controls the first motor controller to change the flight direction of the unmanned aerial vehicle, wherein when the microcontroller determines that the first receiving signal and the second receiving signal are identical and both smaller than a first distance-localization signal intensity, the microcontroller controls the second motor controller such that the unmanned aerial vehicle flies a flying distance towards the controller until the distance therebetween is the predetermined distance; wherein when the microcontroller determines that the first receiving signal and the second receiving signal are identical and both larger than a second distance-localization signal intensity, the microcontroller controls the second motor controller such that the unmanned aerial vehicle flies a flying distance away from the controller until the distance therebetween is the predetermined distance.

20. The unmanned aerial vehicle controlling system according to claim **18**, further comprising:

a plurality of Bluetooth module including a first Bluetooth module having a first serial connection interface and a second Bluetooth module having a second serial connection interface, the first serial connection interface of the first Bluetooth module being coupled between the first directional antenna and a third serial connection interface of the microcontroller, the second serial connection interface of the second Bluetooth module being coupled between the second directional antenna a fourth serial connection interface of the microcontroller, wherein the first Bluetooth module receives the first receiving signal through the first directional antenna and stores the first receiving signal, and wherein the second Bluetooth module receives the second receiving signal through the second directional antenna and stores the second receiving signal.

21. The unmanned aerial vehicle controlling system according to claim **18**, wherein the first directional antenna sends a first emission signal to the controller, and the controller calculates the first receiving signal according to the first emission signal, wherein the second directional antenna sends a second emission signal to the controller, and the controller calculates the second receiving signal according to the second emission signal, and wherein the microcontroller controls the flight direction and the flying distance of the unmanned aerial vehicle in accordance with the difference between the first receiving signal and the second receiving signal.

22. An unmanned aerial vehicle controlling system applicable to the tracking of a controller and the controlling of the flight direction and the flying distance of the unmanned aerial vehicle according to claim **11**, the unmanned aerial vehicle controlling system comprising:

a microcontroller;

a directional antenna coupled to the microcontroller and receiving a localization signal sent from the controller; and

a plurality of motor controllers including a first motor controller and a second motor controller respectively coupled to the microcontroller,

wherein the microcontroller controls the flight direction and the flying distance of the unmanned aerial vehicle through the first motor controller and the second motor controller according to the localization signal such that the distance between the unmanned aerial vehicle and the controller is a predetermined distance.

23. The unmanned aerial vehicle controlling system according to claim **22**, wherein the first motor controller is used for controlling the flight direction of the unmanned aerial vehicle, and the second motor controller is used for controlling the flying distance of the unmanned aerial vehicle, wherein when the microcontroller determines that the localization signal is smaller than a directional-localization signal intensity, the microcontroller controls the first motor controller to change the flight direction of the unmanned aerial vehicle, wherein when the microcontroller determines that the localization signal is smaller than a distance-localization signal intensity, the microcontroller controls the second motor controller such that the unmanned aerial vehicle flies a flying distance towards the controller until the distance therebetween is the predetermined distance, and wherein when the microcontroller determines that the localization signal is larger than the distance-localization signal intensity, the microcontroller controls the second motor controller such that the unmanned aerial vehicle flies a flying distance away from the controller until the distance therebetween is the predetermined distance.

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