the target object cannot be accurately recognized may occur. A situation in which a shadow occurs on a target object as described above is likely to occur in a case where a large step exists on the target object, in an environment in which a plurality of light sources exist, or in a case where another object exists outdoors between sunlight and the target object.

[Summary]

[Technical Problem]

[0006]

Therefore, it is desirable to provide a device or the like that can estimate the position of an unmanned aerial vehicle with respect to a target object by reducing the influence of sunlight or an external light source and its accompanying shadow. Further, it is desirable that the position of an unmanned aerial vehicle with respect to a target object having a step or the like can be accurately estimated.

[Solution to Problem]

[0006a]

According to an aspect, the present disclosure refers to a self-position estimation device in an unmanned aerial vehicle comprising: a light source for irradiating a target object around the unmanned aerial vehicle; a light-collecting sensor for acquiring reflected light from the target object as image data; and a localization unit for estimating a relative position of the unmanned aerial vehicle to the target object using the image data acquired by the light-collecting sensor, wherein the light source includes a laser for emitting light distinguishable from ambient light, and a diffuser for diffusing the light from the laser, and the light-collecting sensor is configured to sense light distinguishable from the ambient light with respect to the reflected light from the target object.

[0006b]

According to another aspect, the present disclosure refers to an unmanned aerial vehicle according to the previous aspect, wherein flight of the unmanned aerial vehicle is controlled by using a relative position of the unmanned aerial vehicle with respect to the target object estimated by the localization device and a speed of the unmanned aerial vehicle.

[0006c]

According to another aspect, the present disclosure refers to a self-position estimation method in an unmanned aerial vehicle, the method comprising: a step of emitting light distinguishable from ambient light from a laser used as a light source; a step of diffusing the emitted light to irradiate a target object around an unmanned aerial vehicle; a step of collecting reflected light from the target object to acquire image data; and a step of estimating a relative position of the unmanned aerial vehicle to the target object by using the acquired image data, wherein the step of acquiring the image data acquires the image data by sensing light distinguishable from the ambient light with respect to reflected light from the target object.

[0007]

The present disclosure has been made in view of the foregoing problem, and has the following examples. According to one example of the present disclosure, there is provided a localization device for an unmanned aerial vehicle that comprises: a light source for irradiating a target object around the unmanned aerial vehicle; a light-collecting sensor for acquiring reflected light from the target object as image data; and a localization unit for estimating a relative position of the unmanned aerial vehicle to the target object using the image data acquired by the light-collecting sensor, wherein the light source includes a laser for emitting light distinguishable from ambient light, and a diffuser for diffusing the light from the laser, and the light-collecting sensor is configured to sense light distinguishable from the ambient light with respect to reflected light from the target object.

[0008]

The present disclosure may further comprise a light source controller for adjusting at least one of emission intensity, position and direction of the laser.

[0009]

In the present disclosure, the light distinguishable from the ambient light may be light of a predetermined band, and the light-collecting sensor may be configured to sense the light of the predetermined band. The predetermined band may include a plurality of bands, and the light-collecting sensor may be configured to sense each of signals of the plurality of bands. The light source may be configured so as to apply light that is different in intensity among the plurality of bands, and the light-collecting sensor may be configured to select which band of light is to be sensed according to a distance to the target object. The light-collecting sensor may be configured to be able to select which band of light is to be sensed for each pixel or for each predetermined region in an image.

[0010]

In the present disclosure, the diffuser may include a wide-angle lens. The diffuser may be configured to form light which is emitted such that light projected from a circumferential portion of the wide-angle lens is brighter than light projected from a center portion.

[0011]

The present disclosure may further comprise, in front of the diffuser, a phosphor reflector for converting a coherent laser into an incoherent spectrum.

[0012]

In the present disclosure, flight of the unmanned aerial vehicle may be controlled by using a relative position of the unmanned aerial vehicle with respect to the target object estimated by the localization device and a speed of the unmanned aerial vehicle.

[0013]

According to another example of the present disclosure, there is provided a method comprising: a step of emitting light distinguishable from ambient light from a laser used as a light source; a step of diffusing the emitted light to irradiate a target object around an unmanned aerial vehicle; a step of collecting reflected light from the target object to acquire image data; and a step of estimating a relative position of the unmanned aerial vehicle to the target object by using the acquired image data, wherein the step of acquiring the image data acquires the image data by sensing light distinguishable from the ambient light with respect to reflected light from the target object.

[0014]

The present disclosure may further comprise a step of setting at least one of emission intensity, position and direction of the light source, wherein the emitting step, the step of irradiating the target object, the step of acquiring the image data, and the estimating step may be executed by using the set light source.

[0015]

In the present disclosure, light distinguishable from the ambient light may be light of a predetermined band, and the step of acquiring the image data may acquire the image data by sensing the light of the predetermined band.

[0016]

In the present disclosure, the predetermined band may have a plurality of bands, and the step of acquiring the image data may sense each of signals of the plurality of bands. The irradiating step may apply light that is different in intensity among the plurality of bands, and the step of acquiring the image data may further comprise a step of selecting which band of light is to be sensed according to a distance to the target object. The step of acquiring the image data may further comprise a step of selecting

[Document Name] Claims

[Claim 1]

A self-position estimation device in an unmanned aerial vehicle comprising:

a light source for irradiating a target object around the unmanned aerial vehicle;

a light-collecting sensor for acquiring reflected light from the target object as image data; and

a localization unit for estimating a relative position of the unmanned aerial vehicle to the target object using the image data acquired by the light-collecting sensor, wherein the light source includes a laser for emitting light distinguishable from ambient light, and a diffuser for diffusing the light from the laser, and the light-collecting sensor is configured to sense light distinguishable from the ambient light with respect to the reflected light from the target object.

[Claim 2]

The self-position estimation device according to claim 1, further comprising a light source controller for adjusting at least one of an emission intensity, a position and a direction of the laser.

[Claim 3]

The self-position estimation device according to claim 1 or 2, wherein the light distinguishable from the ambient light is light of a predetermined band, and the light-collecting sensor is configured to sense the light of the predetermined band.

[Claim 4]

The self-position estimation device according to claim 3, wherein the predetermined band includes a plurality of bands, and the light-collecting sensor is configured to sense each of signals of the plurality of bands.

[Claim 5]

The self-position estimation device according to claim 4, wherein the light source is configured so as to apply light that is different in intensity among the plurality of bands, and the light-collecting sensor is configured to select which band of light is to be sensed according to a distance to the target object.

[Claim 6]

The self-position estimation device according to claim 5, wherein the light-collecting sensor is configured to be able to select which band of light is to be sensed for each pixel or for each predetermined region in an image.

[Claim 7]

The self-position estimation device according to any one of claims 1 to 6, wherein the diffuser includes a wide-angle lens.

[Claim 8]

The self-position estimation device according to claim 7, wherein the diffuser is configured to form light which is emitted such that light projected from a circumferential portion of the wide-angle lens is brighter than light projected from a center portion.

[Claim 9]

The self-position estimation device according to any one of claims 1 to 8, wherein the light source further comprises, in front of the diffuser, a phosphor reflector for converting a coherent laser into an incoherent spectrum.

[Claim 10]

An unmanned aerial vehicle according to any one of claims 1 to 9, wherein flight of the unmanned aerial vehicle is controlled by using a relative position of the unmanned aerial vehicle with respect to the target object estimated by the localization device and a speed of the unmanned aerial vehicle.

[Claim 11]

A self-position estimation method in an unmanned aerial vehicle, the

method comprising:

a step of emitting light distinguishable from ambient light from a laser used as a light source;

a step of diffusing the emitted light to irradiate a target object around an unmanned aerial vehicle;

a step of collecting reflected light from the target object to acquire image data; and

a step of estimating a relative position of the unmanned aerial vehicle to the target object by using the acquired image data, wherein the step of acquiring the image data acquires the image data by sensing light distinguishable from the ambient light with respect to reflected light from the target object.

[Claim 12]

The method according to claim 11, further comprising a step of setting at least one of an emission intensity, a position and a direction of the light source, wherein

the emitting step, the step of irradiating the target object, the step of acquiring the image data, and the estimating step are executed by using the set light source.

[Claim 13]

The method according to claim 11 or 12, wherein the light distinguishable from the ambient light is light of a predetermined band, and the step of acquiring the image data acquires the image data by sensing the light of the predetermined band.

[Claim 14]

The method according to claim 13, wherein the predetermined band has a plurality of bands, and the step of acquiring the image data senses each of signals of the plurality of bands.

[Claim 15]

The method according to claim 14, wherein the irradiating step

applied light that is different in intensity among the plurality of bands, and the step of acquiring the image data further comprises a step of selecting which band of light is to be sensed according to a distance to the target object.

[Claim 16]

The method according to claim 15, wherein the step of acquiring the image data further comprises a step of selecting which band of light is to be sensed for each pixel or for each predetermined region in an image.