DISCLOSURE OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0006] In view of the foregoing, the present disclosure provides a security apparatus and method for forming a virtual security area using a plurality of security apparatuses installed around a protection area. The present disclosure provides a security apparatus and method for forming a virtual security area, including transmitting a signal from the security apparatus to another security apparatus, receiving a signal reflected from the other security apparatus, and determining whether or not an outsider has trespassed based on the received reflection data. The present disclosure provides a security apparatus and method for forming a virtual security area, including forming a plurality of virtual security areas using a plurality of security apparatuses, which enables the construction of an unmanned security system. The problems to be solved by the present disclosure are not limited to the above-described problems. There may be other problems to be solved by the present disclosure.

MEANS FOR SOLVING THE PROBLEMS

[0007] According to an exemplary embodiment, a security apparatus that forms a virtual security area may include a radar sensor that transmits and receives a signal; and a reflector that reflects a signal output from a radar sensor of another security apparatus adjacent to the security apparatus, wherein the security apparatus transmits a signal to a reflector of said another security apparatus adjacent to the security apparatus and receives a signal reflected by the reflector of said another security apparatus through the radar sensor to form a virtual security area between the security apparatus and said another security apparatus, wherein the reflector includes at least two reflecting members, and adjacent reflecting members among the at least two reflecting members are bonded to each other to share one edge, the security apparatus further comprises: an angle adjuster that is extended along a length direction of the shared one edge and is installed on a back of the reflector to adjust an angle of the reflector, and a bracket that adjusts an angle of the radar sensor in a horizontal

direction of the security apparatus in order for the radar sensor of the security apparatus to be positioned to face the reflector of said another security apparatus, the security apparatus searches for a position where an intensity of the signal reflected from the reflector of said another security apparatus is equal to or greater than a reference value by rotating the radar sensor in a horizontal direction using the bracket, and the virtual security area forms a closed loop based on the searched position by fixing the radar sensor in the horizontal direction.

[0008] According to another exemplary embodiment, a security system may include a plurality of security apparatuses that forms a virtual security area, wherein each security apparatus includes a radar sensor that transmits and receives a signal and a reflector that reflects a signal output from a radar sensor of another security apparatus adjacent to the security apparatus, and the plurality

of security apparatuses include at least a first security apparatus, a second security apparatus and a third security apparatus, and a radar sensor of the first security apparatus transmits a signal to a reflector of the second security apparatus adjacent to the first security apparatus and receives a signal reflected by the reflector of the second security apparatus, and a reflector of the first security apparatus receives a signal transmitted from a radar sensor of the third security apparatus adjacent to the first security apparatus and reflects the received signal to the radar sensor of the third security apparatus, and the first security apparatus, the second security apparatus and the third security apparatus form a virtual security area among the first security apparatus, the second security apparatus and the third security apparatus by transmitting and receiving a signal, wherein the reflector includes at least two reflecting members, and adjacent reflecting members among the at least two reflecting members are bonded to each other to share one edge, an angle of the reflector is adjusted by an angle adjuster that is extended along a length direction of the shared one edge and is installed on a back of the reflector, the first security apparatus comprises a bracket that adjusts an angle of the radar sensor of the first security apparatus in a horizontal direction of the first security apparatus in order for the radar sensor of the first security apparatus to be positioned to face the reflector of the second security apparatus, the first security apparatus searches for a position where an intensity of the signal reflected from the reflector of the second security apparatus is equal to or greater than a reference value by rotating the radar sensor in a horizontal direction using the bracket, and the virtual security area forms a closed loop based on the searched position by fixing the radar sensor in the horizontal direction.

[0009] According to another exemplary embodiment, a method for forming a virtual security area by a security apparatus including a radar sensor that transmits and receives a signal and a reflector that reflects a signal output from an external device may include transmitting a signal to a reflector of another security apparatus adjacent to the security apparatus through the radar sensor; receiving a signal reflected by the reflector of said another security apparatus through the radar

sensor; and forming a virtual security area between the security apparatus and said another security apparatus by transmitting and receiving the signal, wherein the reflector includes at least two reflecting members, and adjacent reflecting members among the at least two reflecting members are bonded to each other to share one edge, an angle of the reflector is adjusted by an angle adjuster that is extended along a length direction of the shared one edge and is installed on a back of the reflector the security apparatus comprises a bracket that adjusts an angle of the radar sensor in a horizontal direction of the security apparatus in order for the radar sensor of the security apparatus to be positioned to face the reflector of said another security apparatus, the method further comprises: searching for a position where an intensity of the signal reflected from the reflector of said another security apparatus is equal to or greater than a reference value by rotating the radar sensor in a horizontal direction using the bracket, and forming a closed loop from the virtual security area based on the searched position by fixing the radar sensor in the horizontal direction.

[0010] The above-described exemplary embodiments are provided by way of illustration only and should not be construed as liming the present disclosure. Besides the above-described exemplary embodiments, there may be additional exemplary embodiments described in the accompanying drawings and the detailed description.

EFFECTS OF THE INVENTION

[0011] According to the present disclosure, it is possible to provide a security apparatus and method for forming a virtual security area using a plurality of security apparatuses installed around a protection area. Also, it is possible to provide a security apparatus and method for forming a virtual security area, including transmitting a signal from the security apparatus to another

WE CLAIM

1. A security apparatus that forms a virtual security area, comprising:

a radar sensor that transmits and receives a signal; and

a reflector that reflects a signal output from a radar sensor of another security apparatus adjacent to the security apparatus,

wherein the security apparatus transmits a signal to a reflector of said another security apparatus adjacent to the security apparatus and receives a signal reflected by the reflector of said another security apparatus through the radar sensor to form a virtual security area between the security apparatus and said another security apparatus,

wherein the reflector includes at least two reflecting members, and adjacent reflecting members among the at least two reflecting members are bonded to each other to share one edge,

the security apparatus further comprises:

an angle adjuster that is extended along a length direction of the shared one edge and is installed on a back of the reflector to adjust an angle of the reflector, and

a bracket that adjusts an angle of the radar sensor in a horizontal direction of the security apparatus in order for the radar sensor of the security apparatus to be positioned to face the reflector of said another security apparatus,

the security apparatus searches for a position where an intensity of the signal reflected from the reflector of said another security apparatus is equal to or greater than a reference value by rotating the radar sensor in a horizontal direction using the bracket, and

the virtual security area forms a closed loop based on the searched position by fixing the radar sensor in the horizontal direction.

2. The security apparatus of Claim 1, further comprising:

a case configured to house the radar sensor and the reflector therein,

wherein the security apparatus transmits and receives the signal through at least one side surface formed of an electromagnetic wave transmitting material among a plurality of side surfaces of the case.

3. The security apparatus of Claim 2,

wherein the radar sensor and the reflector are stacked and installed in a height direction of the case.

4. The security apparatus of Claim 1, further comprising:

a first bracket that adjusts an angle of the radar sensor in a height direction of the security apparatus to regulate an amount of signals to be reflected by the reflector of said another security apparatus.

5. The security apparatus of Claim 1,

wherein the reflector has a faceted cylinder shape from which at least one side surface has been removed and is configured to receive the signal through a part with the side surface removed.

6. The security apparatus of Claim 1,

wherein the outermost reflecting member among the at least two reflecting members has an edge which is not shared with another reflecting member and from which a part has been removed.

7. The security apparatus of Claim 1, further comprising:

a measurement unit that measures reflection data of a received signal transmitted by the radar sensor and then reflected by the reflector of said another security apparatus.

8. The security apparatus of Claim 7,

wherein the measurement unit transmits the measured reflection data to a trespass detection server.

9. The security apparatus of Claim 8,

wherein the trespass detection server determines whether or not an outsider has trespassed on the virtual security area formed between the security apparatus and said another security apparatus based on the measured reflection data.

10. The security apparatus of Claim 7, further comprising:

an output unit that outputs a visual or auditory warning message based on the measured reflection data.

11. A security system, comprising:

a plurality of security apparatuses that form a virtual security area,

wherein each security apparatus includes a radar sensor that transmits and receives a signal and a reflector that reflects a signal output from a radar sensor of another security apparatus adjacent to the security apparatus, and

the plurality of security apparatuses include at least a first security apparatus, a second security apparatus and a third security apparatus, and

a radar sensor of the first security apparatus transmits a signal to a reflector of the second security apparatus adjacent to the first security apparatus and receives a signal reflected by the reflector of the second security apparatus, and

a reflector of the first security apparatus receives a signal transmitted from a radar sensor of the third security apparatus adjacent to the first security apparatus and reflects the received signal to the radar sensor of the third security apparatus, and

the first security apparatus, the second security apparatus and the third security apparatus form a virtual security area among the first security apparatus, the second security apparatus and the third security apparatus by transmitting and receiving a signal,

wherein the reflector includes at least two reflecting members, and adjacent reflecting members among the at least two reflecting members are bonded to each other to share one edge,

an angle of the reflector is adjusted by an angle adjuster that is extended along a length direction of the shared one edge and is installed on a back of the reflector,

the first security apparatus comprises a bracket that adjusts an angle of the radar sensor of the first security apparatus in a horizontal direction of the first security apparatus in order for the radar sensor of the first security apparatus to be positioned to face the reflector of the second security apparatus,

the first security apparatus searches for a position where an intensity of the signal reflected from the reflector of the second security apparatus is equal to or greater than a reference value by rotating the radar sensor in a horizontal direction using the bracket, and

the virtual security area forms a closed loop based on the searched position by fixing the radar sensor in the horizontal direction.

12. The security system of Claim 11,

wherein the plurality of security apparatuses are arranged at a predetermined interval around a protection area.

13. The security system of Claim 12,

wherein the plurality of security apparatuses further include measurement units that measure reflection data of received signals respectively transmitted by the radar sensors of the plurality of security apparatuses and then reflected by the reflectors of the plurality of security apparatuses.

14. The security system of Claim 13,

wherein the plurality of security apparatuses further include determination units that determine whether or not an outsider has trespassed on the plurality of virtual security areas enclosing the protection area based on the measured reflection data.

15. The security system of Claim 14,

wherein if the determination units determine that an outsider has trespassed on any one of the plurality of virtual security areas, the determination units estimate that the outsider is located between adjacent security apparatuses that form the virtual security area on which the outsider has trespassed.

16. A method for forming a virtual security area by a security apparatus including a radar sensor that transmits and receives a signal and a reflector that reflects a signal output from an external device, comprising:

transmitting a signal to a reflector of another security apparatus adjacent to the security apparatus through the radar sensor;

receiving a signal reflected by the reflector of said another security apparatus through the radar sensor; and

forming a virtual security area between the security apparatus and said another security apparatus by transmitting and receiving the signal,

wherein the reflector includes at least two reflecting members, and adjacent reflecting members among the at least two reflecting members are bonded to each other to share one edge,

an angle of the reflector is adjusted by an angle adjuster that is extended along a length direction of the shared one edge and is installed on a back of the reflector

the security apparatus comprises a bracket that adjusts an angle of the radar sensor in a horizontal direction of the security apparatus in order for the radar sensor of the security apparatus to be positioned to face the reflector of said another security apparatus,

the method further comprises:

searching for a position where an intensity of the signal reflected from the reflector of said another security apparatus is equal to or greater than a reference value by rotating the radar sensor in a horizontal direction using the bracket, and

forming a closed loop from the virtual security area based on the searched position by fixing the radar sensor in the horizontal direction.