

tag, RSSI and TDOA between the tag and reader, triangulation antenna gain measurement. Thus, passive RFID tags generally result in more accurate location of the tags as compared to active tags. Although cheaper and smaller than active tags, passive tags have shorter read ranges than active tags and require a higher-powered reader.

The advantage of RFID systems is the non-contact, non-line-of-sight nature of the technology. Tags can be read through a variety of substances, including metal, where barcodes or other, traditional optically read technologies would be impractical.

BRIEF DESCRIPTION

In one ~~aspect~~example, a radiofrequency identification (RFID) device includes an active RFID tag that includes a power source and tag identification (TID) data unique to the active RFID tag. The RFID device also includes a passive-RFID tag reader, the passive-RFID tag reader electrically coupled to the power source of the active RFID tag. The active RFID tag is configured to combine the TID data with data received from the passive-RFID tag reader into a combined data file and transmit the combined data file to an active tag reader. The RFID device further includes an optical detector electrically coupled to the active RFID tag and the passive-RFID tag reader. The optical detector is configured to optically detect a condition and output location data to the active RFID tag based on the optically detected condition.

In another ~~aspect~~example, a method of determining the location of an object coupled to a radiofrequency identification (RFID) device includes interrogating a passive tag using a passive RFID tag reader and receiving electronic product code (EPC) data from the passive tag. The EPC data is transmitted to an active RFID tag that is coupled to the passive RFID tag reader. The method also includes optically detecting a condition using an optical detector electrically coupled to the active RFID tag and the passive-RFID tag reader and outputting location data from the optical detector to the active RFID tag based on the optically detected condition. At the active RFID tag, the EPC data is combined with tag identification (TID) data unique to the active RFID tag to form a combined data file, wherein the TID data includes location data. The EPC data and active RFID tag data are combined data file is transmitted from the active RFID tag to an active-RFID tag reader. The location of the object is determined using the EPC data and active RFID tag TID data.

~~In yet another aspect~~As disclosed herein, a system for determining the location of an object using radiofrequency identification (RFID) includes an RFID device having an active RFID tag that includes a power source. The device also includes a passive RFID tag reader electrically coupled to the power source of the active RFID tag. The RFID device is configured

to output electronic product code (EPC) data received from the passive RFID reader and tag identification (TID) data of the active RFID tag. An active RFID reader is configured to receive the outputted EPC data and TID data and determine a location of the RFID device based upon the received EPC data and active RFID data.

A radiofrequency identification (RFID) device comprising an active RFID tag that includes a power source; and a passive RFID tag reader, the passive RFID tag reader electrically coupled to the power source of the active RFID tag.

WHAT IS CLAIMED IS:

1. A radiofrequency identification (RFID) device comprising:

an active RFID tag that includes a power source and tag identification (TID) data unique to the active RFID tag; and

a passive-RFID tag reader, the passive-RFID tag reader electrically coupled to the power source of the active RFID tag, wherein the active RFID tag is configured to:

combine the TID data with data received from the passive-RFID tag reader into a combined data file; and

transmit the combined data file to an active tag reader; and

an optical detector electrically coupled to the active RFID tag and the passive-RFID tag reader, the optical detector configured to:

optically detect a condition; and

output location data to the active RFID tag based on the optically detected condition.

2. The RFID device according to claim 1, further comprising:

an antenna electrically coupled to the passive-RFID tag reader, the antenna configured to directionally send and receive a signal from a passive RFID tag; and

an antenna orientation device configured to orient the direction of the signal.

3. The RFID device according to claim 2, further comprising:

a transmission power control device configured to adjust a transmission power of the signal.

4. The RFID device according to any of claims 1-2, further comprising:

a location engine, the location engine configured to receive data from the active RFID tag and data from the passive-RFID reader, the location engine calculating a present location based upon the received data from the active RFID tag and the passive-RFID reader.

5. The RFID device according to any of claims 1-4, ~~further comprising:~~

~~at least one of a gyroscope and a proximity detector that outputs location data to the active RFID tag wherein the condition is a barcode.~~

6. The RFID device according to any of claims 1-5, wherein ~~the active RFID tag is configured to transmit tag identification (TID) data,~~ the TID data ~~including~~ includes the location data.

7. The RFID device according to any of claims 1-6, wherein the ~~passive~~ RFID tag reader is configured to interrogate a passive RFID tag within a predetermined distance of the ~~passive~~ RFID tag reader, and receive electronic product code (EPC) data from the interrogated tag.

8. The RFID device according to claim 7, wherein the passive RFID tag reader transmits the EPC data to the active tag, and the active tag transmits the EPC data to ~~an~~ the active tag reader as part of the combined data file.

9. A method of determining the location of an object coupled to a radiofrequency identification device, the method comprising:

interrogating a passive tag using a ~~passive~~ RFID tag reader and receiving electronic product code (EPC) data from the passive tag;

transmitting the EPC data to an active RFID tag that is coupled to the ~~passive~~ RFID tag reader;

optically detecting a condition using an optical detector electrically coupled to the active RFID tag and the passive-RFID tag reader;

outputting location data from the optical detector to the active RFID tag based on the optically detected condition;

combining, at the active RFID tag, the EPC data with tag identification (TID) data unique to the active RFID tag to form a combined data file, wherein the TID data includes location data;

transmitting the EPC data and active RFID tag combined data file from the active RFID tag to an active-RFID tag reader;

determining the location of the object using the EPC data and active RFID tag TID data.

10. The method according to claim 9, wherein interrogating the passive RFID tag includes orienting an antenna to a predetermined direction.

11. The method according to any of claims 9-10, ~~further comprising:~~

~~receiving at the active RFID tag supplemental location data from a gyroscope, and including the supplemental location data with the active RFID tag data wherein optically detecting a condition comprises optically detecting a barcode.~~

12. The method according to any of claims 9-11, further comprising:

optically scanning a location marker to receive supplemental location and transmitting the supplemental location data to the active RFID tag, the active RFID tag including the supplemental location data with the ~~active RFID tag~~ TID data.

13. The method according to any of claims 9-12, further comprising interrogating a plurality of passive RFID tags.

14. The method according to any of claims 9-13, further comprising supplying power to the active RFID tag and the passive-RFID tag reader from the same power source.