Localization method of electromagnetic signal-emitting element

INVENTORS: Nepa Paolo
Buffi Alice
Lombardini Fabrizio

PATENT STATUS: GRANTED

PRIORITY NUMBER: MI2011A001017

GRANT DATE: 06/02/2014

PUBLISHED AS: EP

Invention

The invention deals with a **localization method** that finds application in **localizing RFID-UHF tags in relative motion with respect to the RFID-UHF reader.** The method can be applied to locate moving or stationary tags, but also to locate mobile readers installed on board a robot or a drone, using reference tags placed within the scenario.

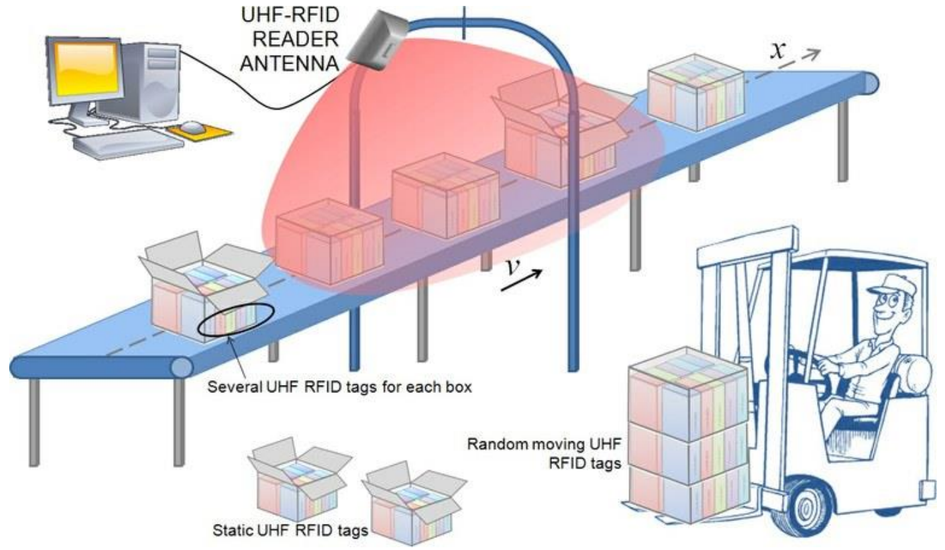
The proposed localization method is based on the principle of ***Synthetic Aperture Radar*** (SAR). It can be applied to determine the location of fixed RFID tags by exploiting the movement of the RFID reader along known trajectories e.g., for logistics applications. It is used also to locate mobile tags with respect to the fixed reader, for example in scenarios where tags are moved by conveyor belts along known trajectories.

Compared to known state-of-the-art localization methods, the present invention presents **an accurate, simple, and cost-effective solution**. Furthermore, by exploiting the phase information of the tag response signal (synthetic aperture approach), it exhibits greater **robustness** than systems using signal intensity information that may vary depending on obstacles or other environmental factors, greatly affecting localization accuracy, especially in indoor scenarios.

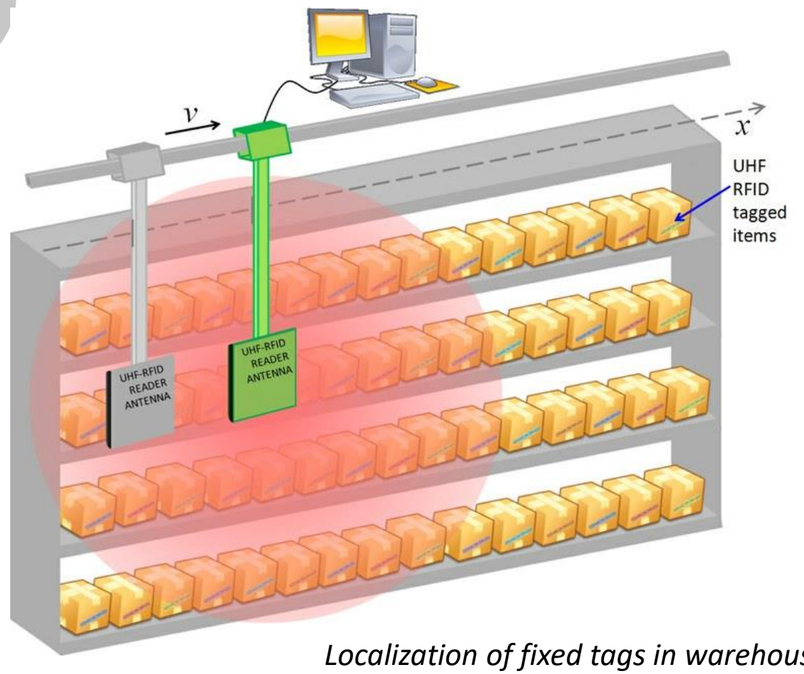
The proposed system uses a commercial RFID hardware operating in UHF band without requiring *ad hoc* modifications of the reader. These systems can manage **simultaneously dozens of passive tags** without battery and easy to install.

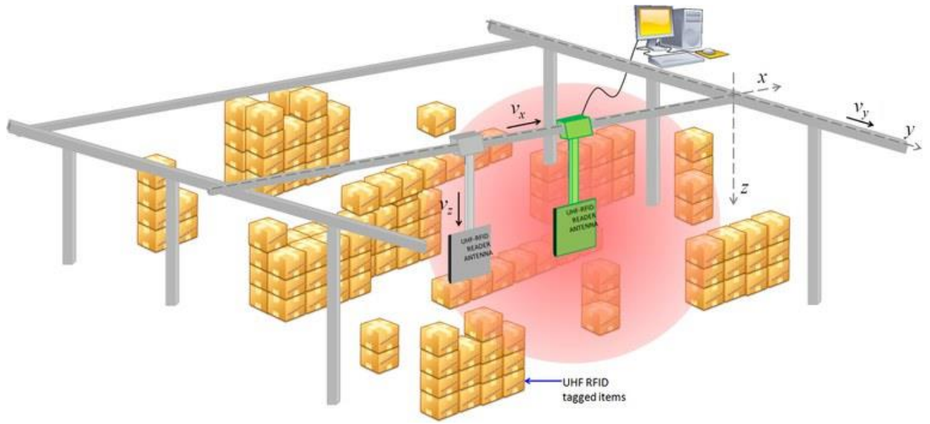
It can be used both **indoors and outdoors** and does not require a complex infrastructure of antennas.

Drawings & pictures



Locating moving tags along a conveyor belt with a fixed antenna.





Localization of fixed tags in warehouses, bookstores, shelves, using mobile antenna.

Industrial applications

The system is based on the use of **low-cost commercial hardware** and **passive, battery-free, maintenance-free tags**. The infrastructure used is **simple** and characterized using a **single antenna that is easy to install**. No calibration is required, and the system guarantees **high flexibility and scalability** with respect to the application scenario.

These features give the invention numerous fields of application such as:

- management of moving objects along conveyor belts (e.g.: baggage management in airports);
- management of goods/components along production lines;
- management of indoor/outdoor warehouses;
- precision agriculture;
- infrastructure monitoring;
- integration in the activity of drones and robots used in Industry 4.0 and *Industrial Internet of Things* applications.

Possible developments

The technology has been tested in real-world scenarios demonstrating that UHF-UHF tags can be clearly identified and located with a localization error on the order of a centimeter.

The method is also able to discern tagged objects on the conveyor belt from any other tagged object that is within the read range of the reader antenna.

The invention could be used in warehouses, oriented to a progressive process of **industrial automation and integration between systems** (physical and digital) in the context of production and storage processes, carried out in order to increase the productivity and production quality of plants in various scenarios of **Industry 4.0** and ***Industrial Internet of Things.***

For more information:

Tech Transfer Office of University of Pisa

Headquarters: Lungarno Pacinotti 43/44, Pisa (PI) 56126

Web site: www.unipi.it/index.php/trasferimento

E-mail: valorizzazionericerca@unipi.it

For more information:

Ufficio Regionale di Trasferimento Tecnologico

Headquarters: Via Luigi Carlo Farini, 8 50121 Firenze (FI)

E-mail: urtt@regione.toscana.it

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urtt Ufficio Regionale di Trasferimento Tecnologico