November 2022

Externally Powering Wireless Real-Time Locating System Tags

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Abstract:

This publication describes techniques and apparatuses relating to powering wireless real-time locating system tags (e.g., RTLS tags) through an external power source (e.g., an additional DC battery, connection to an AC power source). The external power source may be in addition to power supplied by the internal battery of the RTLS tag or in substitution of internal battery power. The techniques and apparatuses may include accessories utilized to externally power an RTLS tag through an external power source. One example accessory is utilized with a RTLS tag that includes a housing that can be opened by a consumer to replace the battery (e.g., by removal of a battery cover panel). In this example, the accessory is a replacement battery cover panel for the RTLS tag. By providing additional power to the RTLS tag, additional capabilities and use cases are possible. For example, use cases that benefit from lower latency and higher accuracy Angle of Arrival measurements.

Keywords:

Power accessory, external battery, external power, ultra-wideband (UWB), ultra-high frequency, real-time locating system (RTLS) tag, finder tag, location tag, smart tag, security tag, stationary, Bluetooth low energy (BLE), Angle of Arrival (AoA), low latency, wireless advertisement, home automation

Background:

A user may utilize a computing device called a wireless real-time locating system (RTLS) tag (e.g., a "finder TAG") for location-based purposes in a mobile mode (e.g., locating misplaced personal belongings, monitoring pet locations, tracking assets), as well as, in a stationary mode (e.g., home automation). RTLS tags are battery-powered via a small, internal battery (e.g., button cell, coin cell, watch battery) that has a low output voltage. A RTLS tag utilizes a transmitted beacon (e.g., an ultra-wideband (UWB) beacon, Bluetooth low energy (BLE) beacon) to broadcast a unique identifier that a nearby computing device can receive. The computing device may then document/report an observation of the RTLS tag and/or interact with the RTLS tag. An observation may include time/date information, the unique identifier, and/or geolocation information.

To conserve the limited battery life of an RTLS tag, a typical implementation is configured with a latency between beacon transmissions of 1 to 3 seconds. Such latency is not suitable for certain applications that require a lower latency between transmissions. For example, when an RTLS tag is used to locate an item of high importance, a high latency interferes with the user's ability to locate their item in real time.

As an additional way to conserve the limited battery life of an RTLS tag, a typical RTLS tag implementation will utilize a low transmission power. Many methods of locating a RTLS tag utilize signal measurements (e.g., a Received Signal Strength (RSS), an Angle of Arrival (AoA)) of a signal(s) transmitted by the RTLS tag. The low transmission power of RTLS can greatly impact these signal measurements, which can limit potential applications for RTLS tags (e.g., to those use cases that do not require high accuracy AoA).

Description:

This publication describes techniques and apparatuses relating to powering wireless real-time locating system tags (e.g., RTLS tags) through an external power source (e.g., an additional DC battery, connection to an AC power source). The external power source may be in addition to power supplied by the internal battery of the RTLS tag or in substitution of internal battery power. By providing additional power to the RTLS tag, additional capabilities and use cases are possible.

The techniques and apparatuses may include accessories utilized to externally power an RTLS tag through an external power source. A first example accessory is illustrated in Fig. 1, which illustrates a RTLS tag that includes a housing that can be opened by a consumer to replace the battery (e.g., by removal of a battery cover panel). In this example, the accessory is a replacement battery cover panel for the RTLS tag that includes connectors configured to interface with the existing battery contacts of the RTLS tag and a power connector that extends through the replacement battery cover panel. The power connector may be a USB-C receptacle connector or the like. A power cable can then be connected between an AC/DC adapter and the power connector of the RTLS tag to provide additional voltage to the RTLS tag. In a second example, the RTLS tag includes a power connector on its housing configured for receiving power via a power cable.

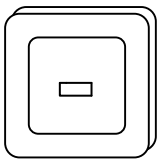

Figure 1: Real Time Locating System Tag

The techniques and apparatuses relating to powering RTLS tags through an external power source further include improved RTLS tags. An improved RTLS tag may include one or more of a processor, a transceiver (e.g., ultra-wideband transceiver, Bluetooth transceiver) for

transmitting/receiving data, and a computer-readable medium (CRM) for storing device data. The CRM may include any suitable memory or storage device (e.g., flash memory).

The device data includes instructions of a Power Manager module that can be executed by the processor. The Power Manager module represents functionality that detects the connection to the external power source and changes a configuration of the RTLS tag. The use of the term "configuration" in this publication refers to a mode of operation of the RTLS tag. The mode of operation may include a configuration parameter—a value that can be set or modified, and is used to perform a function. For example, the value of a configuration parameter may determine what functionality of the RTLS tag is enabled or disabled.

The Power Manager module may detect the presence of the connection to the external power source through monitoring and analyzing power data (e.g., input voltage, power quality, power consumption) for the device. For example, if the Power Manager module measures that the input voltage for the device has increased from a voltage indicative of battery power (e.g., an input voltage of less than 3V) to a voltage indicative of external power (e.g., a voltage greater than 3.5V), the Power Manager module may determine that an external power source is present.

Responsive to determining that an external power source is present, the Power Manager module may cause a change in a configuration of the RTLS tag that enables or disables a functionality of the RTLS tag. For example, a first example operation, responsive to determining that an external power source is present, the Power Manager module changes a configuration of the RTLS tag to increase a transmission frequency of a transceiver (e.g., an ultra-wide band (UWB) transceiver) of the RTLS tag. For example, by changing the wireless advertisement window to enable more signals to be transmitted. The increase in number of signals transmitted may increase the accuracy of the signal location estimations. For example, a nearby smartphone can receive

these signals from the RTLS tag and provide a more accurate location. Further, a change in the wireless advertisement window also means that more signals can be transmitted within a period of time. The faster propagation of signals lowers the delay (e.g., latency) of information from one device to another. Thus, a larger wireless advertisement window lowers the overall latency of the RTLS tag.

In a second example operation, responsive to determining that an external power source is present, the Power Manager module changes a configuration of the RTLS tag to increase the radio frequency (RF) transmission power of the RTLS tag. The increase of RF transmission power enables a more accurate and real-time reading of the location signals by a computing device.

A configuration change that enables or disables a functionality of the RTLS tag (e.g., increases the advertisement window, increases RF transmission power) may enable additional use cases for the RTLS tag. In one example use case, the RTLS tag is externally powered and is used in a stationary mode where the RTLS tag is attached to or positioned relative to a home automation-enabled device (e.g., a television, a lamp) in a home automation system. The externally powered RTLS tag may be configured with an increased advertisement window and/or increased RF transmission power. As a result, data can be exchanged with a computing device (e.g., smartphone) faster and more accurately, improving the user experience. For example, an increased advertisement window may make the home automation device respond faster when a user points their smartphone at the home automation device (e.g., the television) and provides input (e.g., a gesture) on their smartphone to interact with the device (e.g., turn on the device).

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