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**McCall et al.**

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(54) **ELECTRONIC PHYSICAL ASSET TRACKING**

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(58) **Field of Search** ..... 455/41, 456, 458, 455/466, 422, 9, 134, 229, 456.1, 422.1; 340/991, 992, 988, 989, 825.49, 572.1, 572.4, 5.8, 10.1, 505

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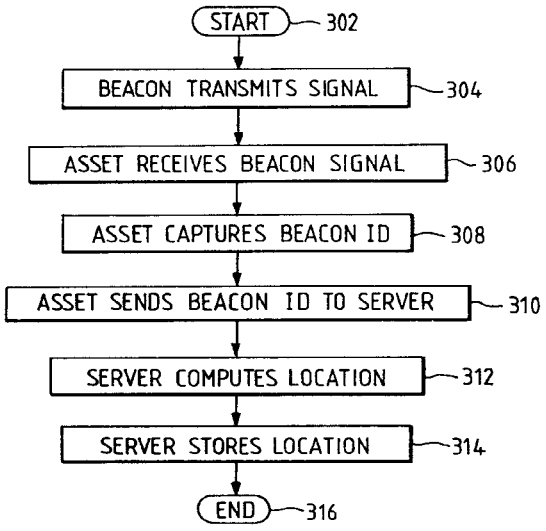
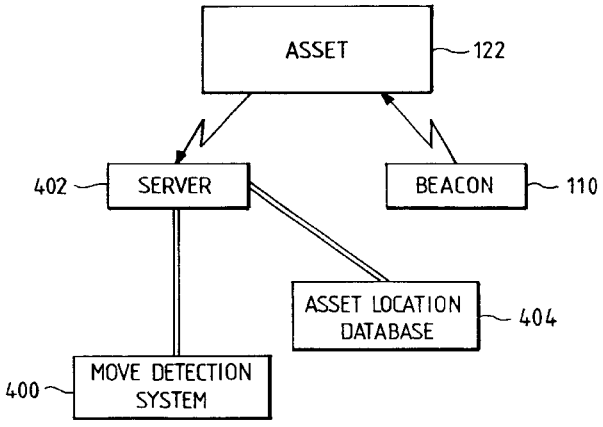
(57) **ABSTRACT**

Objects can be tracked within a building using a radio device associated with each object to be tracked and an array of transmitting beacons. Each of the beacons transmits identification data. The received identification data from the object to be tracked is sent to a server which determines the location of the object. The identification data may be sent from the object to the server using a data communications network such as a local area network. The beacons may have a variable power output allowing the receipt or non-receipt of the signal from the beacon to be used to assist in locating the object. The beacons may be associated with an existing wireless communication mechanism, such as Bluetooth.

**2 Claims, 3 Drawing Sheets**



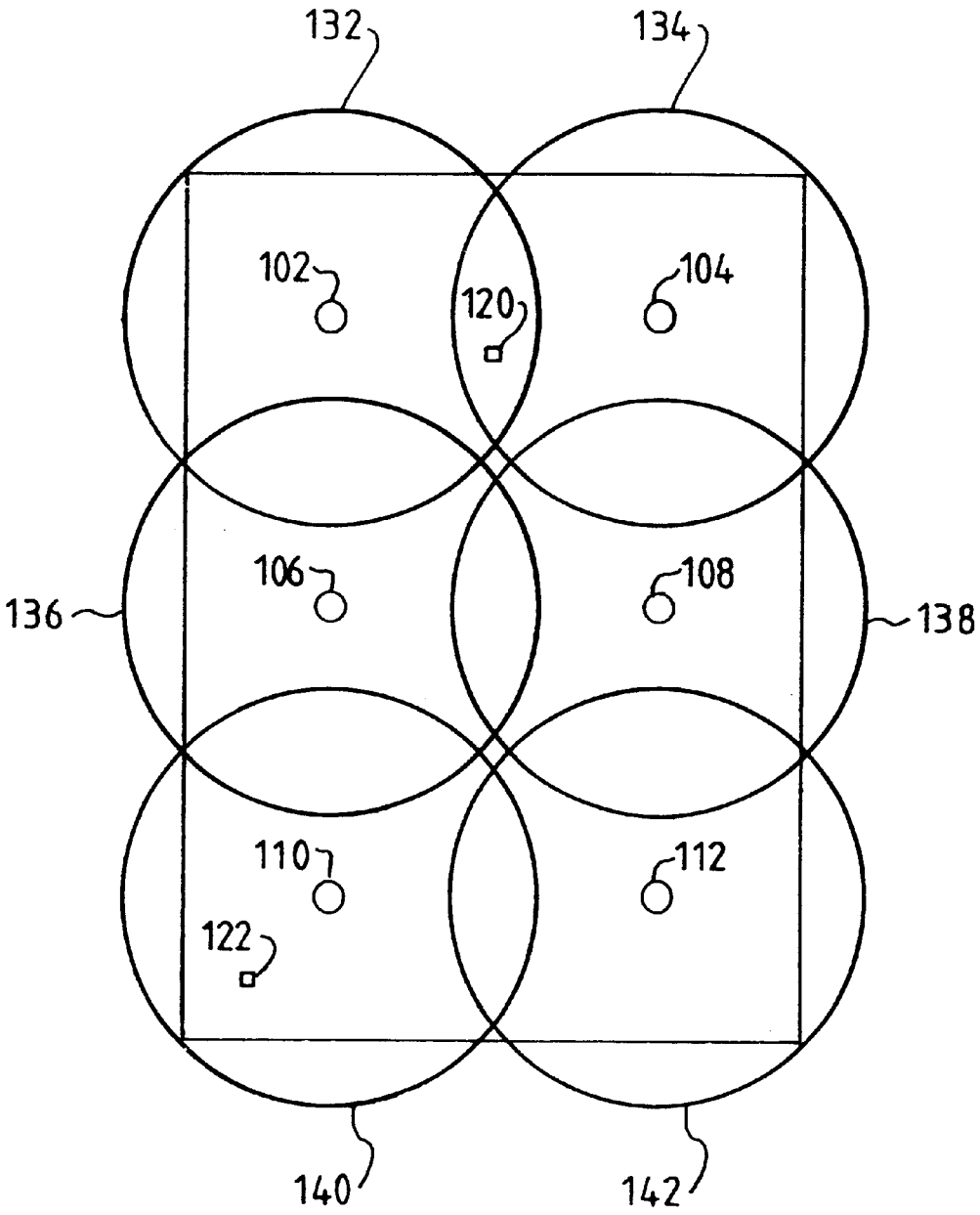



FIG. 1

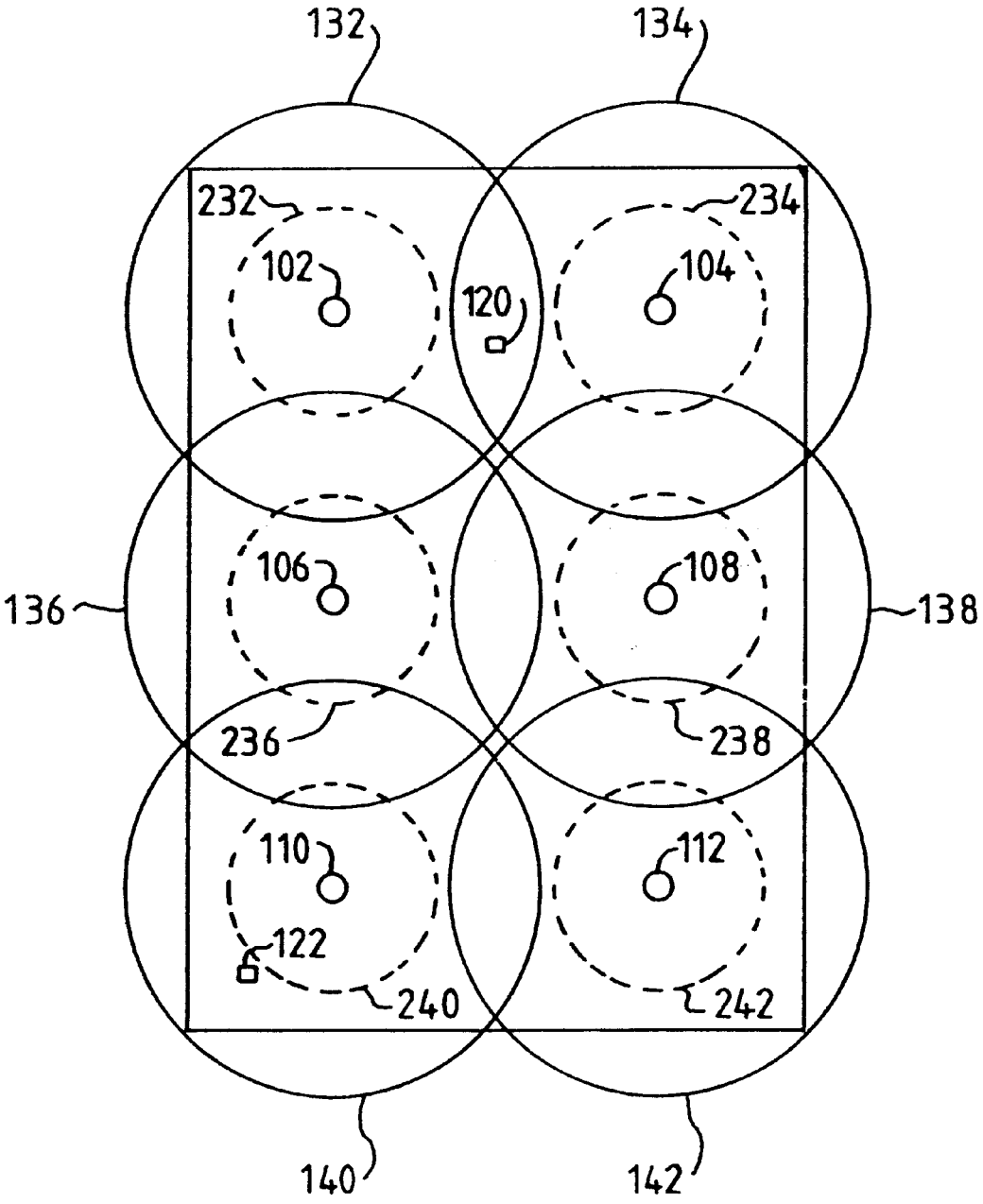



FIG. 2

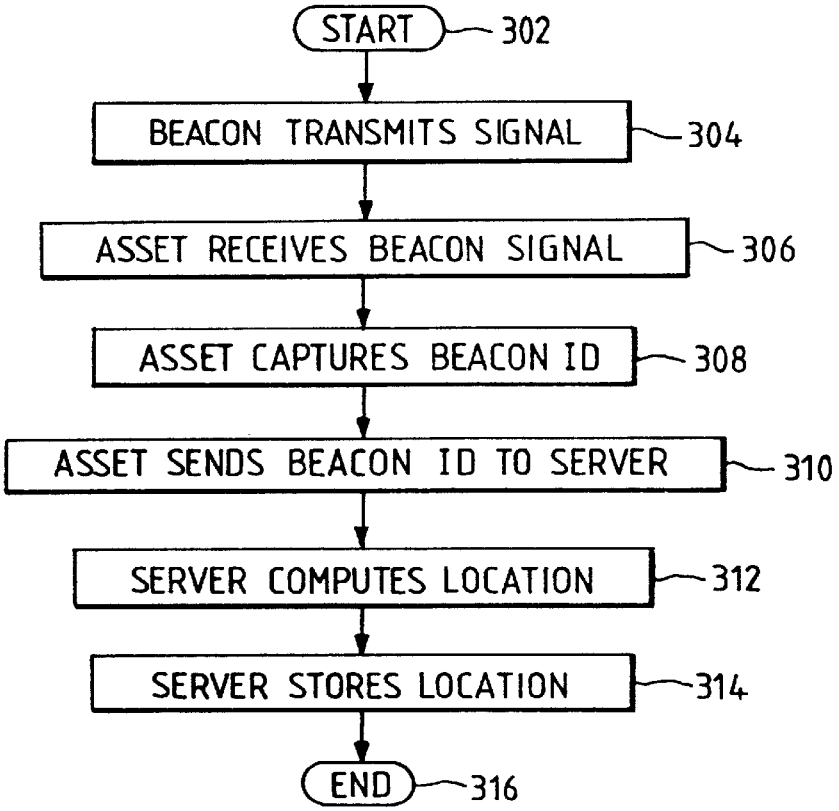



FIG. 3

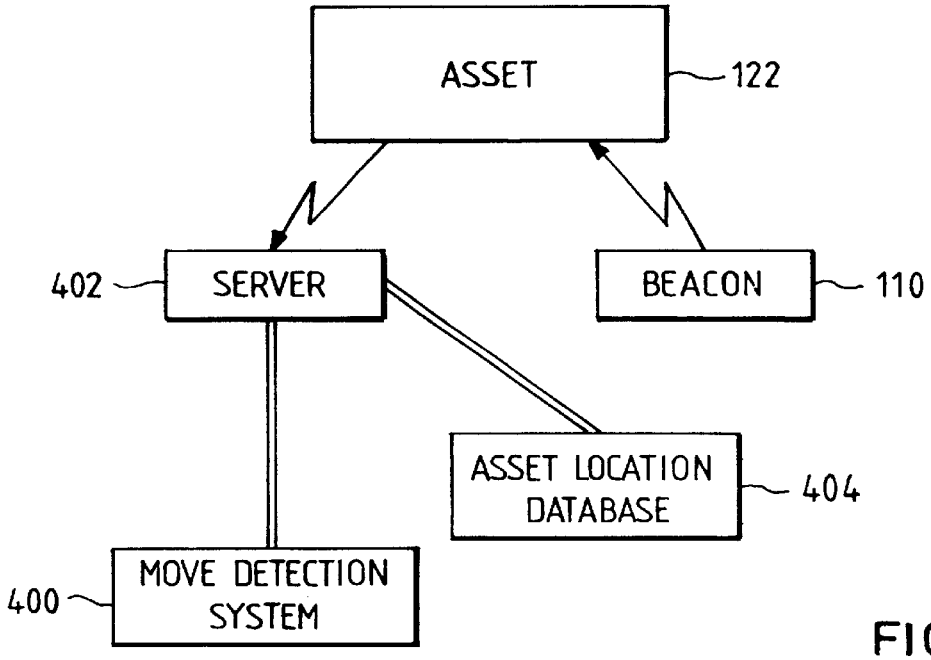



FIG. 4

# ELECTRONIC PHYSICAL ASSET TRACKING

## FIELD OF THE INVENTION

The present invention relates to systems for tracking the location of objects by means of a transceiver or a receiver associated with each of the objects together with a chain of transceiving or transmitting radio beacons and a conventional computer network.

## BACKGROUND OF THE INVENTION

In any organisation where physical information technology (IT) hardware assets such as personal computers, mobiles computers, server computers and printers are used, it is important to effectively manage each asset. One area of IT asset management which is regarded as time consuming, difficult and very expensive, is recording the physical position of each IT asset. The problem is further exacerbated with the present large scale adoption of mobile computing devices, which are easily transported, but are difficult to track. Losing control of the physical location of assets leads to accounting irregularities and investment planning disruption.

The most widely adopted method is physical inventory taking. This involves identifying and recording each asset by either physically going to it, or getting users to send data to a central point. This is not a good solution because:

(i) Users don't always respond;

(ii) Data is only current for that moment in time, i.e. a user can enter data and then move the asset;

(iii) Is not very secure; and

(iv) Is time consuming.

Integrated management applications generally rely on information entered by hand either at the managed system or at the management console to identify the system's location. Often this information becomes out of date because the person moving the system is not aware that the information had to be updated, or how to update it.

As systems management and troubleshooting becomes more automated, and pre-emptive maintenance is becoming more prevalent, alerts to the system manager that intervention is required at a remote system will come from the system itself, not the user, so it is imperative that location information is kept up to date. As an example, a bank branch system may report that intervention is required and as a result of the report, a technician is dispatched to the wrong town because the asset database is out of date.

Asset tracking is a well understood problem and has had several solutions applied to try and solve. One method currently being used is the inclusion of a Radio Frequency Identification (RFID) chip inside the asset. The data on this chip (typically Vital Product Data (VPD)), can be scanned using a hand held scanner, without the need to remove the asset from the packaging. This approach records the VPD of the asset, but NOT the physical position, and is also confined to around a 1 meter distance between scanner and asset.

Systems are known in which the location of individuals or objects are tracked by the use of tags attached to the individual or object. The tags receive a signal from a cell controller and reply by radio to the cell controller with the tags unique identification number. This unique identification number can be used to identify the individual or object to



different antennas, thus enabling the tag location to be precisely determined. Typical of these products is the 3D-iD Local Positioning System from PinPoint Corporation. A description of the product can be found at www.pinpoint-co.com. The cell controllers typically have a range of 250 feet (76 meters) and are dedicated for the purpose of asset tracking. The cell controllers calculate the tag location using precise time references to determine the distance of the tag from the controller.

U.S. Pat. No. 5,708,423 discloses a zone based asset tracking and control system in which each object has an associated object marker which transmits a unique id signal. As the object moves through doorways its signal is received by a sensor which transmits this information to a central data processing system.

Radio location solutions such as the Global Positioning System (GPS) can locate an asset to a very high degree of accuracy, and lightweight GPS implementations are inexpensive, but GPS does not work inside buildings. Other radio based location systems like Decca or Loran require expensive, specialised, radio frequency circuitry at both the beacon and the asset. Many radio based location systems depend on the use of directional antennae, either mechanically rotated or phased arrays.

It would be desirable to provide an asset tracking system that did not require the use of dedicated hardware such as cell controllers and also did not require hardware that was required to use a precise time reference in order to determine the location of the tag.

## DISCLOSURE OF THE INVENTION

Accordingly, the present invention provides apparatus for tracking the location of one or more objects, the apparatus comprising: one or more beacons, each beacon transmitting identification data; one or more radio devices, each radio device being associated with one of the objects, each radio device being capable of receiving a signal from any one or more of said beacons; data processing apparatus, in communication with the one or more objects, for receiving identification data from the one or more objects, the identification data being derived from the transmitted identification data.

The apparatus can be used to automatically updates location information in a manner that needs no user intervention and is transparent to the overall management system.

The beacons can be part of an existing wireless communication system using, for example, the Bluetooth technology. Such technology is likely to become standard equipment for mobile and desktop computing within a few years and is inexpensive to implement.

The location mechanism uses a dense array of beacons, rather than a sparse array and so location does not depend on the direction of the beacons from the objects, only the presence of the beacon within range. because of this a simple, inexpensive omnidirectional antenna can be used.

In a preferred embodiment, communication between the data processing apparatus and the one or more objects is through a data communications network, and more preferably, a local area network.

In a preferred embodiment, only the receipt or non-receipt of a signal from the one or more beacons is used to determine the location of an object.

In an alternative embodiment, one or more of the one or

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