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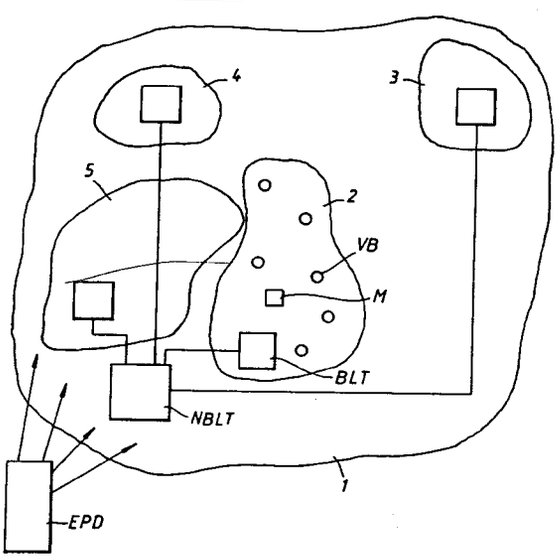
(54) Arrangement in a system including mobile units.

(57) A system comprises mobile units and virtual beacons/radio beacons (VB). An arrangement determines whether a mobile unit passes an affected beacon. A unit (BLT) extracts a first position information produced by the system for the current virtual beacon. Elements are arranged to determine if the said passage exists or not in dependence on a comparison function with the second position information relating to the position of the mobile and extracted from an external position determining system (EPD).

Fig.1



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TECHNICAL FIELD

The present invention relates to an arrangement for determining, in a system which includes, on the one hand, mobile units, for example a road transport information system (RTI), and, on the other hand, virtual beacons (radio beacons), the passage of a respective mobile unit past a respective beacon.

PRIOR ART

From American Patent Specification 5,043,736, it is already known to utilize a cellular locating system. The system consists of a portable locating unit which can be used both as mobile telephone and for global positioning. The unit has a receiver for receiving signals from a global positioning system (GPS) and circuits for calculating the position. The position thus obtained is then transmitted via a mobile telephone system to the central unit. In the central unit, there is a possibility for correlating the position obtained with a stored digital map for placing the user on the actual location on the map.

In American Patent Specification US 4,701,760, a method for positioning vehicles and for providing communication between the vehicles and a central unit is described. Coordinates of the vehicles are determined with the aid of an omega network and corrected when passing control beacons.

In European Patent Application 242,099, a method for locating a vehicle, for example when a car is stolen, is shown. A unit in the vehicle calculates the position of the vehicle with the aid of a GPS system. This position is transmitted to a central monitoring station via a mobile telephone system if a break-in is detected or if a change of the position is detected.

The publication "Integrated Land and Coastal Navigation Using a Differential GPS receiving System, the Third International Conference On Beacle Navigation and Information system, N Cheong, 1991, Volume 1, pages 380-386" discloses an integrated navigation system based on differential GPS. The system is intended for both sea and land vehicles and utilizes the base stations in a cellular mobile telephone system for transmitting the DGPS signals to the user on land.

The above references thus show different possibilities for determining the position of a vehicle, for example a mobile unit, with the aid of external positioning systems together with a communications system which can be of the mobile type.

DESCRIPTION OF THE INVENTION

TECHNICAL PROBLEM

A beacon is a location where short-range data transactions for RTI (Road Transport Informatics) can be carried out. The range of a beacon is 10 - 500 metres depending on the technology used. Beacon systems are not continuous and do not operate with handover capability. The coverage is thus patchy by area without coverage in between.

The data structure in a beacon system is adapted to the discontinuous coverage. When passing a beacon, the vehicle obtains standard set-up data which describes the traffic level of the nearest surrounding area. The vehicle reports the traffic situation on the distance just travelled, which is then used by the beacon system for updating the traffic situation in its entirety. Individual transactions for a range of applications can also be carried out.

Detecting a beacon when passing it is done by external influences, for example carrier wave detection or at protocol level with, for example, End System Hello (ESH). After detection, data transactions can be carried out. The position of the vehicle is determined auto-nomously in the vehicle (with dead reckoning). The quality of the position becomes progressively worse, which is why the position must be calibrated. In a real beacon system, calibration of the position of the vehicle is done when passing a beacon.

In an alternative access method for the same information infrastructure through a cellular network such as GSM, a beacon passage must be logically initiated internally in the vehicle. This is because no real beacon is physically passed in a virtual system. Moreover, the position must be determined with a non-autonomous system since automatic external calibration capabilities are lacking when real beacons cannot be passed (are not accessible in the environment). The problem is to provide the vehicle with a valid position of sufficiently high quality and to determine when a virtual beacon can be passed (VBLS). The present invention has the aim of solving the above problem.

SOLUTION

The feature which may principally be regarded as characterizing the invention is that a unit (BLT) is arranged to extract a first position information produced by the system for a current virtual beacon, and that elements are arranged for determining if a passage exists or not in dependence on a comparison with a second position information relating to the position of the mobile and extracted from an external position determining system.

In one embodiment, the external position determining system can consist of a system known per se, for example the global positioning system GPS, the differential global positioning system DGPX, the said systems in combination with dead reckoning, and so forth.

In a further embodiment, the unit (BLT) serves a part area of an area which is covered by the mobile

system, and the mobile system thereby specifies positions produced or calculated for the virtual beacons in the part area. The mobile system is arranged with a master unit which controls a number of part area units. A respective part area unit (BLT) specifies in table form the positions of virtual beacons within the part area, and the relevant table is updated with a real or virtual beacon address.

In a further embodiment, the master unit (NBLT) is provided with or has stored all access telephone numbers and positions for virtual beacons in the system.

The said comparison-effecting elements are arranged for producing a difference signal with the said comparison and to indicate, with a predetermined value of the difference signal, whether a passage of an affected virtual beacon exists. A certain predetermined position difference is allowed and all values of the signal under a predetermined value can indicate a passage. The signal value difference can be arranged to be adjustable.

ADVANTAGES

By means of what has been proposed above, an appropriate indication of whether a passage of a virtual beacon exists for a current mobile unit or not is obtained. Equipment known per se can be utilized for carrying out the ideas behind the invention. Thus, for example, similar processor and display units can be used in the mobile units or vehicles for both real and virtual beacon access. It can be mentioned here that real beacon access is developed and produced today by a number of enterprises. By means of the invention, the position obtained can be compared with positions stored centrally and/or in the vehicle for producing control nodes where the vehicle can take part in an information transfer.

The invention makes it possible to change the system by simple means due to the fact that virtual beacons can be moved, increased, shut down and so forth. Such a changeability is intended to occur preferably also during operation.

All beacon-based systems which operate in dual-mode operation with, for example, the mobile system GSN can be provided with VBLD when the system is used in GSN mode. If real beacons exist in the system, carrier waves or ESH indicate the presence of the beacons in question. In the absence of real beacons, virtual beacon locations must be defined, which is done by means of the present invention. The parameter AUP specifies an uncertainty parameter which can be related to the greatest position difference (spacing) between EPD and BLT which can be accepted as an indication when a virtual beacon is passed. AUP is thus an adjustable parameter which, when the value drops below it, generates an event, a virtual beacon passage. The event, a virtual beacon passage, is a novelty in this connection. From the point of view of the vehicle application this is functionally identical with a real beacon passage.

DESCRIPTION OF THE FIGURES

A currently proposed embodiment of an arrangement which shows the characteristics significant of the invention will be described below, at the same time referring to the attached drawing, in which:

Figure 1 basically shows a mobile system with virtual beacons and mobile units which can move within the part areas in a total area which is covered by the system, and

Figure 2 shows in a block diagram form a comparison function between the positions of the mobile units and the virtual beacons.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

In Figure 1, a coverage area for a mobile system known per se is specified by 1. The mobile system can consist of the RTI system mentioned in the introduction. This system is well known per se and will not be described in great detail here, apart from the connections between the system and the ideas of the present invention. Coverage within the area 1 is discontinuous and the part areas within the area 1 which is covered are specified by 2, 3, 4 and 5. A unit BLT (Beacon Location Table) belongs to each respective part area, for example part area 2. This BLT can be placed centrally within the area or in a respective mobile unit. The BLT unit specifies the positions of virtual beacons of the system in the nearest surrounding area or in the part area, for example part area 2. The BLT unit operates with a table which is updated on access of a real or virtual beacon.

For the virtual beacon system 1 according to Figure 1, a central master BLT unit, here called NBLT, is arranged. All access telephone numbers and positions of virtual beacons are stored in this NBLT. The virtual beacons of the systems can be moved or added to through changes in the NBLT, something which would be costly in a real beacon system. The changes can also be carried out during operation. The system changes come into force in the entire system with respective downloading to local BLTs.

In accordance with the invention, an external position determining system EPD is utilized. This can be of a type known per se in accordance with the above. The external position determining system EPD determines the positions of the mobile units. In accordance with the concept of the invention, it will be possible to determine the passage of a mobile M past a virtual beacon VB. The position of the said virtual beacon is specified in the system through the BLT unit, and the system can thus extract a first position

information 11 which can be assigned to the position of a current virtual beacon. The EPD system can extract a second position information I2 for the mobile unit M which passes the said virtual beacon. In accordance with Figure 2, a comparison function exists in the system, which comparison information can be entered in the BLT and/or NBLT unit(s). The comparison function can be effected by a comparison element 6 of a type known per se. The comparison results in a signal or parameter AUP. Since the position from the EPD system has a degree of uncertainty, a certain error must be accepted in the AUP parameter. AUP stands for Area Uncertainty Parameter. The AUP parameter specifies the greatest position difference or spacing between EPD and BLT which is accepted as an indication that a virtual beacon is being passed.

The invention is not limited to the embodiment shown above by way of example, but can be subjected to modifications within the scope of the patent claims following and the concept of the invention.

Claims

1. Arrangement for determining, in a system comprising mobile units (M), for example a road transport information system (RTI), and virtual beacons (radio beacons VB), the passage of a respective mobile unit past a respective beacon, characterized in that a unit (BLT) is arranged to extract a first position information (I1) produced by the system for a current virtual beacon (VB), and that elements (6) are arranged to determine whether there is a passage or not in dependence on a comparison with a second position information (I2) relating to the position of the mobile and extracted from an external position determining system (EPD).

2. Arrangement according to Claim 2, characterized in that the external position determining system (EPI) consists of a system known per se, for example the global positioning system GPS, the differential global positioning system DGPS, the said systems in combination with dead reckoning, and so forth.

3. Arrangement according to Claim 1 or 2, characterized in that the unit (BLT) serves a part area (2, 3, 4 or 5) which is covered by the mobile system and thereby specifies positions, produced by the mobile system, for the virtual beacons (VB) in a respective part area, and that the mobile system is- arranged with a master unit (MBLT) which controls a number of part area units (BLT).

4. Arrangement according to Claim 1, 2 or 3, characterized in that a respective part area unit (PLT) in table form specifies virtual beacons within the part area (2, 3, 4 or 5) and that the table concerned is updated with a real and/or beacon address.

5. Arrangement according to any of the preceding claims, characterized in that the master unit (NBLT) is provided with or has stored access telephone numbers and positions of virtual beacons, whereby a simple changeability is produced in that the virtual beacons of the system can be moved, increased, shut down etc., which changeability is intended also to occur preferably during operation of the system, and that said changes can be downloaded in a respective part area unit (BLT).

6. Arrangement according to any of the preceding claims, characterized in that a said comparison-effecting element (6) is intended to effect a difference signal or parameter (AUP) on comparison, and that a predetermined value or predetermined magnitude of the difference signal indicates whether a passage exists at the virtual beacon concerned.

7. Arrangement according to Claim 6, characterized in that a certain predetermined position difference is also calculated and that all values of the signal or parameter below the predetermined value or within a current value range indicate a passage.

8. Arrangement according to Claim 6 or 7, characterized in that the allowed signal value or parameter difference is arranged to be adjustable.

9. Arrangement according to any of the preceding claims, characterized in that when a passage of a current beacon has been established, the mobile unit/vehicle obtains data from the system, and that the mobile unit reports the traffic situation on the distance just travelled to the current beacon for enabling the beacon system to update the traffic situation, in addition to which an individual transaction or individual transactions for a range of applications can be carried out.

10. Arrangement according to any of the preceding claims, characterized in that processor and display units known per se can be used for both real and virtual beacon access.

Fig. 1

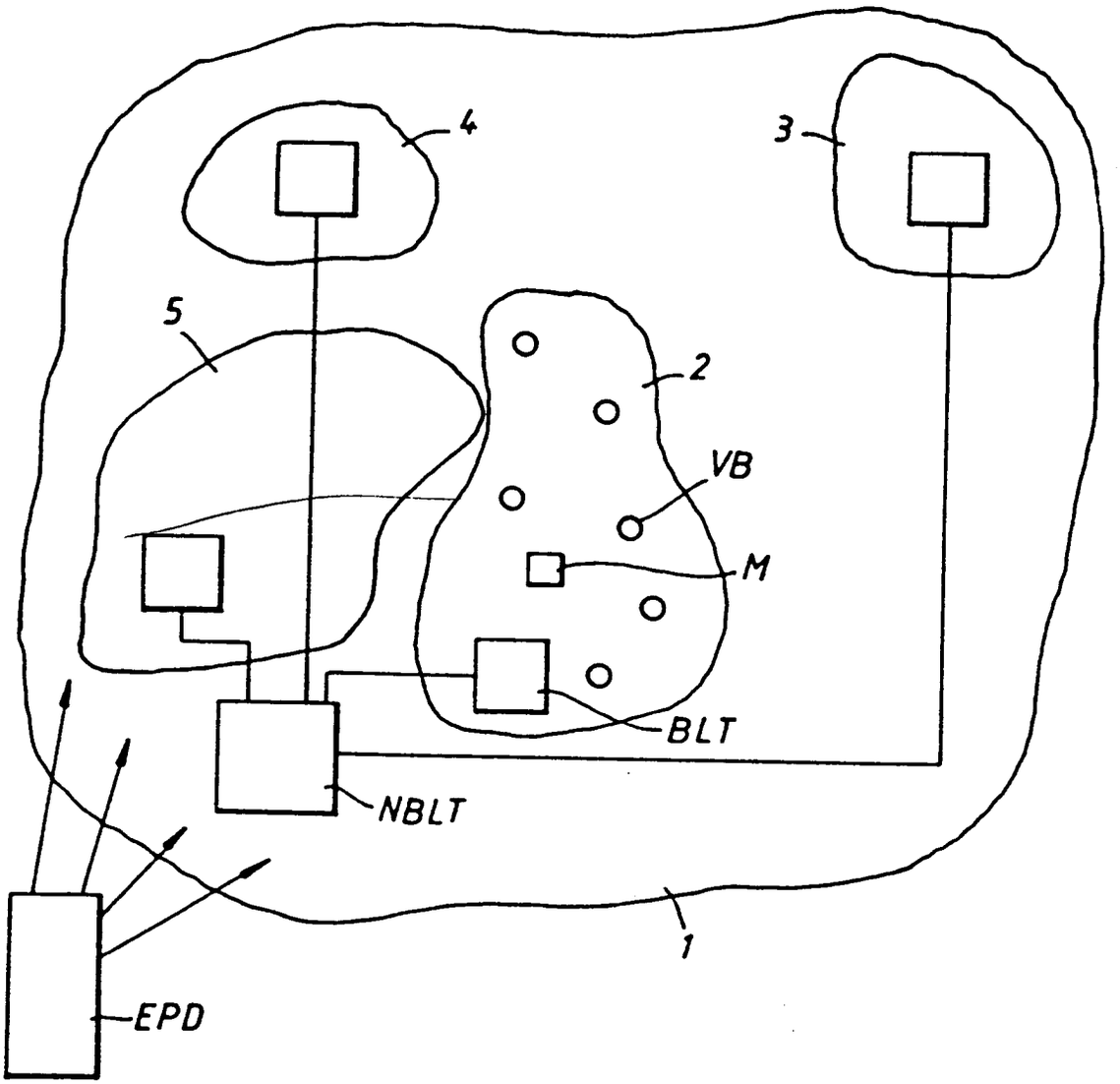

Fig. 2