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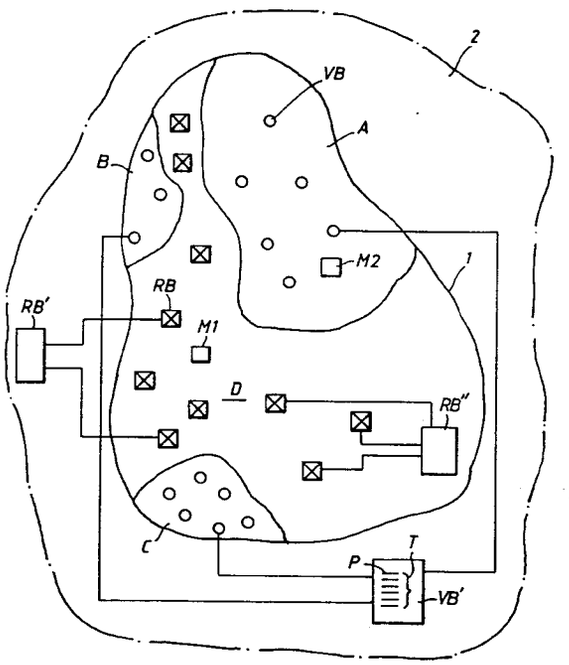
(54) Arrangement in a mobile system, for example a system for short-range communication.

(57) In a mobile system of the RTI type, that is to say a system of short-range communication, between a vehicle and the roadside, beacons or radio beacons are utilized. Information on traffic, for example vehicle traffic, is exchanged between the said beacons and the mobile units when the latter pass respective beacons. At least some of the beacons of the mobile system (1) are of the virtual type (VB). This means that positions (P) which represent the said virtual beacons (VB) are specified in the system, preferably in centrally placed elements (VB'). An alternative medium (2) cooperates in order to access data between a respective mobile unit (M2) and a respective virtual beacon (VB).



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TECHNICAL FIELD

The present invention relates to an arrangement in a mobile system, for example the RTI system which is a system for short-range communication between a vehicle and the roadside. The mobile system comprises mobile units and beacons (radio beacons), by means of which information on traffic, for example vehicle traffic, can be executed in dependence on information transferred from the mobile units to the said beacons, and vice versa, when the mobile units are passing the latter.

PRIOR ART

The RTI system, for example, is based on data communication between a vehicle and the roadside. The data communication requires a new infrastructure built around beacons with short range.

In the publication "Integrated Communication Architecture for Road Transport Informatics, second international conference on beacon navigation and information systems, N Wall et al. 1991, volume 2, pages 923 - 928, ISBN: 07800304888", different ways of introducing an RTI system by integrating existing systems, for example RDS-TNC, GSM-based SOKRATES, beacon systems and so forth are discussed. A virtual RTI system based on an infrastructure with a multiplicity of communication systems including GSM, beacons and satellites is also briefly disclosed. However, the virtual network is only discussed superficially.

In European Patent Specification EP 172 320 913 a method for locating a mobile telephone is specified. The fixed base stations transmit identity signals and precise timing pulses from their fixed locations. The signal transfer occurs either as a response to an interrogation signal from the mobile or automatically at predetermined time intervals. The mobile unit can utilize internally stored tables of positions of the fixed base stations when calculating its own positions. The method is intended to be used for monitoring and controlling vehicle traffic. The method entails that high costs for setting up a new fixed infrastructure for traffic monitoring can be avoided.

European Patent Specification 242,099 describes a method for locating a vehicle, for example in the case of the theft of a car. 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 in position is detected.

American Patent Specification US 5,043,736 discloses 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 to the central unit via a mobile telephone system. The central unit contains a capability for correlating the position obtained with a stored digital map in order to place the user at his current location on the map.

As prior art, reference can also be made to American Patent Specification US 4,701,760 which describes a method for positioning vehicles and for making possible communication between the vehicles and a central unit. The coordinates of the vehicles are determined with the aid of an omega network and corrected when control beacons are passed.

In the publication "Integration of GPS and Dead-reckoning Navigation Systems, second international conference on beacon navigation and information systems, W Kao, 1991, volume 2, pages 635 - 643, ISBN: 780304888", a positioning system is described which utilizes both GPS and dead-reckoning for improving the accuracy in, for example, a traffic monitoring/road guidance system.

It is thus known to position vehicles by different means and to transfer position data and other data between the vehicles and a central unit by different means. In the known cases, the position determination and data transfer occur via other media than fixed beacons. It is thus known to utilize an existing positioning system for determining the position of a vehicle and then to transfer this position via an existing communication network of, for example, cellular type to a centrally placed unit. The position information is correlated with a centrally stored database containing terrain maps, for example a digital map.

DESCRIPTION OF THE INVENTION

The invention can be used, inter alia, in RTI (Road Transport Informatics) systems which to a large extent will probably be built on data access through beacon systems, that is to say special systems for short-range access between a vehicle and the roadside. The range of a beacon is 10 - 500 metres depending on the technology used. Beacon systems are not continuous and do not have a hand-over capability which thus entails patchy coverage with areas without coverage inbetween.

The data structure in a beacon system is adapted to the discontinuous coverage. On passing a beacon, the vehicle receives a standard set of data which describes the traffic environment of the nearest surrounding area. The vehicle reports the traffic situation on the route most recently travelled which is then used by the beacon system for updating the traffic situation. Individual transactions for a range of applications can also be carried out.

Applications and hardware in the car will most probably be produced specially for beacon systems.

The equipment will only function in areas with a well-developed beacon system. The development of a beacon infrastructure is costly and can only be justified in areas with a large population base. Apart from parts of Stockholm and Göteborg, all of Sweden can be considered to be sparsely populated in this connection.

For reasons of infrastructure costs, beacon systems cannot be developed in all parts of the country where there is need. The pace of development is limited by the will to take economic risks. Nor will customers buy the system or subscribe to it before the extent of development is good and there is adequate application access.

GSM offers an attractive alternative medium for area coverage when the user population is moderate. The use of GSM has been investigated, inter alia, in the so-called SOKRATES project which has an information structure which is radically different from the structure of short-range communication systems. In order to introduce SOKRATES, new services must also be introduced in GSM (broadcast, or respectively a low-quality mass uplink for statistical data collection etc.). However, standardization organizations have no plans to introduce these functions in a foreseeable time.

Since SOKRATES is wholly based on cellular technology, the narrow frequency band of the cellular system limits capacity. The invention intends, inter alia, to solve the problems specified above.

SOLUTION

That which can be mainly considered to be characterizing of the novel arrangement is, inter alia, that at least some of the beacons of the mobile system are of a virtual type, by which is meant that positions which represent the said virtual beacons are specified in the system, preferably in the centrally placed elements of the system, and that an alternative medium, for example a cellular mobile telephone system which can be of a known type, cooperates in order to access data between a respective mobile unit and a respective virtual beacon.

In one embodiment of the concept of the invention, virtual beacons are placed out in the mobile system, during its development phase, in less traffic- and/or use-intensive areas of the total coverage area of the mobile system. With increased traffic or, respectively, use in the said areas, the virtual beacons are replaced by real beacons, which saves frequency in the area(s) where the replacement occurs.

In an alternative embodiment, a number of operable parallel mobile systems are included which are allocated to competitors or are complementary to one another. The complementary systems can operate with a common basic database and be directed, with matching services, to interested parties, for example petrol firms which then obtain the opportunity, through the system, of marketing, for example information sections which emphasise their own product, for example a hotel, goods or petrol, and are priced free.

In one embodiment, similar or the same data structures can be used both for real and virtual beacons. In the case with a real beacon, the data are stored locally in the affected beacon, which is placed at the roadside or in the vicinity of the road. In the case with virtual beacons, the data are stored centrally since the local node does not exist in reality. When the virtual beacon is replaced by a real beacon, the centrally stored data are transferred to the real beacon, that is to say the data are executed locally. Even if the main part of all communication takes place with a virtual beacon, some of the services affected can utilize the characteristics of the cellular carrier system whereby it becomes possible for the virtual beacon system to utilize advantages which are associated both with the beacon-oriented system and the cellular system.

In the said embodiments, virtual beacons included in the system are placed outside the areas of the system with the most traffic or greatest traffic load.

The position function is in control when contact is established between a respective mobile unit and respective virtual beacon which entails that a significant proportion of the RTI traffic in heavily loaded geographic areas is avoided or alternatively that designation of real beacons can take place. RTI traffic can thus be directed towards base stations with less loading and a more even total loading structure be achieved in the cellular system, for example the GSM system.

ADVANTAGES

Through that which has been proposed above, the investment risk for real beacons can be minimized before market acceptance and service maturity are attained. Coverage is attained in areas which cannot economically justify real beacons. Contributions to for example GSM development in sparsely populated areas can be obtained through this new type of traffic, as well as an increased traffic data base in sparsely populated areas as a short-term situation. All locations with lack of capacity are provided with real beacons so that competition between RTI and call customers does not need to be experienced. A virtual beacon system can be given a very high capacity increase for RTI, partly due to the fact that virtual beacons are placed where the carrying system has lower capacity utilization and partly through implementing real beacons where the communication requirement is high.

In principle, virtual beacon systems can be tailor-made for larger customers. The flexibility is consider-

able as compared with traditional beacon systems. Virtual beacon systems can be operated, for example in Sweden, but also in networks of operators of other countries within Europe, assuming that the carrying system is GSM.

The invention supplements beacon-based systems with functional capabilities in areas without beacons. Functionalities which were lost by there not being any beacon coverage are replaced, and such functionalities can be position determination and data access. The SOKRATES project has the aim of providing the same functionality with, for example, GSM access as does the beacon system. The problem with SOKRATES is, however, that the data and application structures are in principle different from beacon systems. Separate database and application infrastructures must be built up if the system is to be put into operation. Vehicles which wish to use both beacon-based applications and SOKRATES must have double sets of processor and display units in the vehicles. This takes up space and costs money, apart from the fact that it is impractical to handle, for example, two parallel road guidance systems in one and the same vehicle. SOKRATES requires new GSM functions which are not going to be introduced within the foreseeable future.

DESCRIPTION OF THE FIGURE

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

the figure shows in basic diagram form a coverage area of a mobile system where virtual beacons are set up in first partial areas and real beacons are set up in a second partial area.

In the figure, a coverage area of a beacon-oriented system according to the invention is shown by 1. The coverage area comprises a number of partial areas A, B and C where so-called virtual beacons VB have been set up. The said partial areas A, B and C are areas which have least traffic loading and utilization. Area D is highly loaded from the point of view of traffic and provided with real beacons RB. Mobile units are moving within the areas and a first mobile unit has been specified by M1 in area D. On passing a real beacon, information or data relating to traffic loading in the nearest surrounding area are transferred from the real beacon to the mobile unit M1. The mobile unit M1 in turn transfers information about the driving of the mobile unit, traffic conditions etc. to the real beacon RB. The majority of data received is stored locally in the totality of real beacons RB. However, there is a connection to a higher-level unit RB' which is connected to all the real beacons for certain information exchange in the system.

The virtual beacons VB naturally lack local anchorage in the same way as the real beacons etc. which is why all data relating to traffic intensity, loading are stored centrally, preferably in a central higher-level unit VB' which is common to all the beacons in the different partial areas. Each partial area can per se have a separate higher-level VB'. The said virtual beacons VB are stored in the central unit VB' where the virtual beacons are represented through positions, the geographic positions, which they have been allocated in the different areas A, B and C. When mobile units M2 pass a respective virtual beacon VB, data information is to be exchanged in corresponding manner between the respective mobile unit and the respective virtual beacon. Access and transmission take place at frequencies which belong to a cellular mobile telephony system which is located in the area of the beacon-oriented system. The cellular system has been symbolized by 2 in the figure and can consist of a mobile telephone system known per se, preferably the GSM system. In the illustrative embodiment, the beacon-oriented system consists of the so-called RTI system.

In the virtual beacon-oriented system, the virtual beacons can be exchanged, increased in number, reduced in number or replaced with the said real beacons RB, in each case depending on a change in the traffic intensity, traffic loadings, vehicle types and so forth. In accordance with the figure, one or more control elements RB' and RB" can be arranged for the said real beacons.

The invention is not limited to the embodiments shown as examples above but can be subjected to modifications within the scope of the subsequent patent claims and the concept of the invention.

Claims

1. Arrangement in a mobile system, for example the RTI system, which is a system of short-range communication between vehicles and the roadside, and comprising mobile units (M1, M2), and beacons (radio beacons) (VB, RB), by means of which information on traffic, for example vehicle traffic, can be executed in dependence on information transferred between the said beacons and the mobile units when the latter pass the said beacons, characterized in that at least some of the beacons of the mobile system are of the virtual type (VB), by which is meant that positions (P) which represent the said virtual beacons are specified in the system, preferably in centrally placed elements (VB'), and that an alternative medium, for example a cellular mobile telephony system (2) which can be of known type, cooperates in order to access data between a respective mobile unit and a respective virtual beacon.

2. Arrangement according to Claim 1, characterized in that, in a development phase of the mobile system with beacons, virtual beacons are placed out in less traffic- and/or use-intensive areas (A, B, C) of the total coverage area (A+B+C+D) of the mobile system, and that with increased traffic or use in the said areas, the virtual beacons (VB) are replaced by real beacons (RB), which saves frequency in the area or areas where the replacement occurs.

3. Arrangement according to Claim 1 or 2, characterized in that it comprises a number of operable parallel mobile systems which are allocated to competitors or which are complementary to each other.

4. Arrangement according to Claim 1, 2 or 3, characterized in that in the case of complementary systems, these systems operate with a common basic database and are directed with matching services to interested parties, for example petrol companies which then, through the system are given the possibility of marketing, for example, information sections which favour their own product or products, for example hotels, goods or petrol, and do not charge for the information sections.

5. Arrangement according to Claim 1, 2, 3 or 4, characterized in that similar or the same data structure can be used for real and virtual beacons, in that in the case of real beacons, data are stored locally in the beacon affected which is placed at the roadside or at a similar location, in that in the case of virtual beacons, data are stored centrally since no local nodes exist, and in that when a virtual beacon or beacons is or are replaced by one or more real beacons, the centrally stored data are conducted out to the locally placed beacon or locally placed beacons.

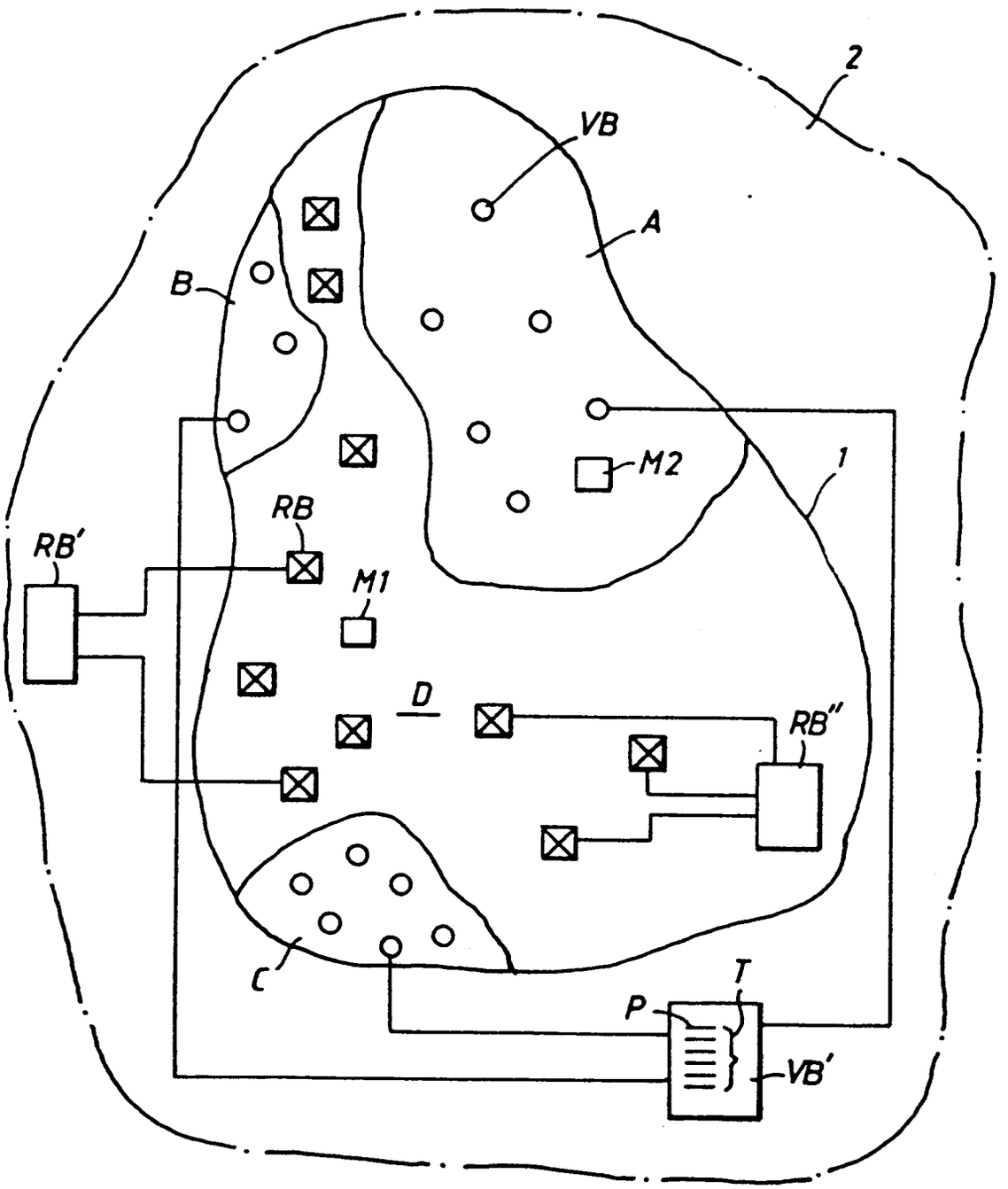
6. Arrangement according to any of the preceding claims, characterized in that even if the main part of all communication takes place in a virtual beacon, some of the services affected can utilize the characteristics of the carrying cellular system whereby it becomes possible for the virtual beacon system to utilize advantages which are associated both with the beacon-oriented system and the cellular system.

7. Arrangement according to any of the preceding claims, characterized in that virtual beacons included in the system are placed outside the areas with the greatest traffic load in the system, in that the position function determines when contact is established between a respective mobile unit and a virtual beacon, meaning that a significant proportion of all RTI traffic in heavily loaded geographic areas (D) is avoided or, alternatively, an exchange with real beacons occurs, whereby, in this manner, RTI traffic can be directed to base stations with less loading and a more even total loading structure is achieved in the cellular system/GSM system.

8. Arrangement according to any of the preceding claims, characterized in that virtual beacons are placed out in the area of systems where the carrying system, for example the cellular system, has a lower capacity utilization, with a virtual beacon system providing a significantly increased capacity increase for the RTI system.

9. Arrangement according to any of the preceding claims, characterized in that the real beacons are placed where there is great demand for communication.

10. Arrangement according to any of the preceding claims, characterized in that the virtual beacons are represented centrally in table form (T) in the mobile system.


2
VB
A
B
M2
1
RB
RB'
M1
D
RB''
C
T
P
VB'