(12) PATENT
(19) AUSTRALIAN PATENT OFFICE

(11) Application No. AU 200165755 B2
(10) Patent No. 777407

(54) Title
Navigation method and device

(51)6 International Patent Classification(s)
G01C 021/36

(21) Application No: 200165755

(22) Application Date: 2001.04.27

(87) WIPO No: WO01/84082

(30) Priority Data

(31) Number	(32) Date	(33) Country
10021171	2000.04.29	DE

(43) Publication Date : 2001.11.12
(43) Publication Journal Date : 2002.01.31
(44) Accepted Journal Date : 2004.10.14

(71) Applicant(s)
Robert Bosch GmbH

(72) Inventor(s)
Ralf Duckeck

(74) Agent/Attorney
Callinan Lawrie,Private Bag 7,KEW VIC 3101

(56) Related Art
US 6028553
EP 845658
EP 943896

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro

(43) Internationales Veröffentlichungsdatum
8. November 2001 (08.11.2001)

PCT

(10) Internationale Veröffentlichungsnummer
WO 01/84082 A1

(51) Internationale Patentklassifikation⁷: G01C 21/36

(21) Internationales Aktenzeichen: PCT/DE01/01587

(22) Internationales Anmeldedatum:
27. April 2001 (27.04.2001)

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

(30) Angaben zur Priorität:
100 21 171.2 29. April 2000 (29.04.2000) DE

(71) Anmelder *(für alle Bestimmungsstaaten mit Ausnahme von US)*: ROBERT BOSCH GMBH [DE/DE]; Postfach 30 02 20, 70442 Stuttgart (DE).

(72) Erfinder; und
(75) Erfinder/Anmelder *(nur für US)*: DUCKECK, Ralf [DE/DE]; Zierenbergstr. 11, 31137 Hildesheim (DE).

(81) Bestimmungsstaaten *(national)*: AU, US.

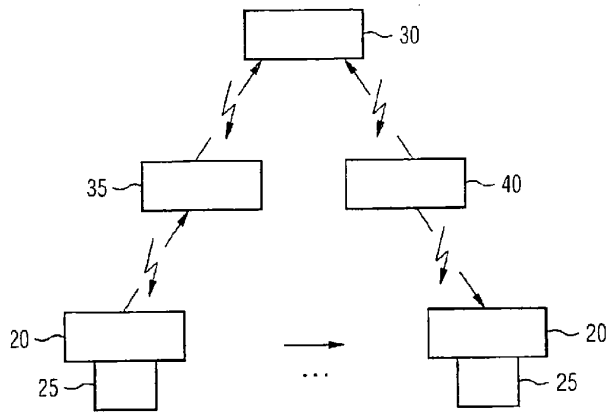
(84) Bestimmungsstaaten *(regional)*: europäisches Patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR).

Veröffentlicht:
— *mit internationalem Recherchenbericht*
— *vor Ablauf der für Änderungen der Ansprüche geltenden Frist; Veröffentlichung wird wiederholt, falls Änderungen eintreffen*

[Fortsetzung auf der nächsten Seite]

(54) Title: NAVIGATION METHOD AND DEVICE

(54) Bezeichnung: NAVIGATIONSVERFAHREN UND -VORRICHTUNG



(57) Abstract: The invention relates to navigation methods and devices, especially for use in vehicle navigation systems. In the event that recommended alternatives are required, essentially only the information (40) that is necessary for travelling the alternative section of the original route is transmitted from a central traffic guidance system to the vehicle navigation system. According to the invention, this information essentially only represents deviations from the route calculated in the vehicle navigation system.

[Fortsetzung auf der nächsten Seite]

WO 01/84082 A1

Zur Erklärung der Zweibuchstaben-Codes, und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

(57) Zusammenfassung: Die vorliegende Erfindung betrifft Navigationsverfahren und -vorrichtungen, insbesondere zum Einsatz in Fahrzeug-Navigationssystemen. Es werden im Bedarfsfall einer Ausweichempfehlung im wesentlichen nur diejenigen Informationen (40) von einer Verkehrsleitzentrale an das KFZ-Navigationssystem übermittelt, die für die Befahrung eines alternativen Streckenabschnitts der Ursprungsroute erforderlich sind. Diese Informationen stellen erfindungsgemäss im wesentlichen nur Abweichungen von der im Kraftfahrzeug-Navigationssystem berechneten Route dar.

Navigation method and device

Prior Art

The present invention relates to a navigation device and a navigation method for use in particular in vehicle navigation systems.

Although applicable to any information system with an information supply from an external point or control centre to a multiplicity of information recipients, the present invention and the problem it addresses will be explained with reference to a navigation system on board an automobile and its internetworking to a central traffic guidance facility.

The present day on-board navigation systems consist primarily of the following sub-systems: digital street directory, computer module for route computation, position determining device, system administration, vehicle sensors for the detection of vehicle movements, input unit and output unit for operation and navigation.

The on-board navigation systems are in a position to implement the planning of a route autonomously and independently after the input of the start and destination according to various criteria. Newer systems can process digital traffic information, which is received, for example, via RDS-TMC or GSM and compute detour routes. A disadvantage of such a highly developed on-board system, however, consists in that the detour route for a traffic obstacle cannot be determined with respect to the traffic situation on this detour route or on other alternative routes. Moreover, such systems are not in a position to react beforehand to a changed traffic situation influenced precisely by such detoured traffic flows.

Furthermore, so-called off-board navigation systems are known, in which the intelligence is located in a centre, from which the route is calculated and transmitted with the aid of beacons or radio telephones (GSM). A combined off/on-board navigation system is disclosed in EP 0 184 448. This system is additionally in a position, like an on-board system, to calculate a start-destination route. In order, however, to recommend to the driver as suitable a route in the event of currently arisen traffic disturbances as possible, it will be proposed in this document that the start-destination route be calculated in the data terminal device and simultaneously request a route from the centre. The centre will then calculate the route taking into account the current traffic situation and changed traffic conditions, as they can exist, for example, due to special traffic direction because of construction sites, etc. When the route is calculated in the centre, it will be "prognosticated" as to how far the user has driven in the meantime and then the complete remainder of the route to his destination is transmitted to the data terminal device.

This method is a so-called hybrid method, as it combines the operation of on-board systems with that of off-board systems. This, however, has the disadvantage that in certain circumstances very large amounts of data must be transmitted, which can lead, in the case of many users of the system, to a heavy loading of the radio network (GSM) and, in addition, high transfer costs in terms of mobile telephone charges. The reason for this is that the complete residual route, beginning with the current vehicle position and ending with the programmed destination is transferred via the mobile telephone network. A heavy loading of the radio network can, in the worst case scenario, lead to a considerable delay in the transferral of data and to an overloading of the transmission channel.

Summary of the Invention

According to the present invention there is provided a navigation method for use in vehicle navigation systems, said method including the steps of: calculating a route in a vehicle navigation system on board a vehicle; and transmitting information from a control centre to the vehicle navigation system for the purpose of planning an optimised route, wherein in the step of transmitting information from the control centre to the vehicle navigation system only delta information representing the required necessary deviations from a previously calculated route for driving an alternative section of the route is transmitted.

Advantages of the invention

The method of the invention and the corresponding device have the advantage that the loading of the radio network is reduced to a considerable extent.

According to the invention it is proposed that the data necessary for an optimised route planning, which must be transmitted from a traffic direction centre to a vehicle navigation system, be reduced to a minimum. Only that information is used, which is necessary for taking an alternative section of the route. This information represents departures from the route calculated in the vehicle navigation system and is therefore referred to as delta information. Based on this measure, the entire amount of data to be transmitted, even with a high number of users remains, relatively slight and the cost for the individual user remains low.

The concept on which the present invention is based consists, then, primarily in that only the actually necessary information is transmitted over the mobile phone network and the computing resources on board the vehicle for the computing of routes efficiently is calculated.

In contrast with pure off-board methods, according to one aspect of the present invention, if the traffic situation is smooth and without disturbances, no data transfer at all takes place between the traffic direction central and the vehicle navigation system, whereas the pure off-board systems must transmit all route information from the start to the destination.

According to a preferred further development, the vehicle navigation system provides, for the initiation of an optimised route planning, the current vehicle position, the route destination and certain databank version information to the central road traffic centre. From this information, the centre can conclude with which current and possibly also future traffic disturbances an individual user of the system can reckon with. The databank version information provides information about which databank information with respect to the various route sections can be called up locally in the vehicle and can be processed autonomously there. This minimum of information is sufficient to transmit the necessary information to the vehicle navigation system.

Brief Description of the Drawings

Embodiments of the invention are shown in the drawings and are described in the following description in some detail.

Shown are:

Fig. 1 a schematic block diagram with the main steps of the method of the invention during the trip according to a preferred embodiment,

Fig. 2 a schematic diagram with the important functional elements, which are involved in the method of the invention, and

Fig. 3 a schematic section of a street directory.

Detailed Description of the Preferred Embodiments

Fig. 1 shows a schematic block diagram with the main steps during the trip for the method of the invention according to a preferred embodiment.

In a Step 100 the user starts the navigation system at the beginning of his/her trip.

In a Step 110 he/she inputs the trip destination. Then the vehicular navigation system determines the current position of the vehicle, Step 120. In a Step 130 the preference parameters of the user are read in by the system, that is it is established whether the user would like to be directed along the quickest or for example the shortest route. In this case the user selects the quickest route.

In a Step 140 the on-board navigation system calculates autonomously with the resources present in the vehicle, such as the traffic network inventory data, eg. from a databank stored on a CD and a computer the route desired by the user.

Then in a Step 150 the vehicle position, its destination, the preference parameters and a version identification number, which identifies the current version of the inventory databank of the vehicle navigation system, is transmitted to the next closest road traffic guidance centre.

At this point reference is simultaneously made to Fig. 2. Fig. 2 shows a schematic diagram with the main functional elements, which take part in the method of the invention. In the left part of Fig. 2 the vehicle is illustrated with the reference mark 20. It possesses a navigation system 25. The centre mentioned above is indicated with the reference mark 30.

The data transmitted by means of mobile telephone communication in Step 150 containing position, destination, preference parameters and software version number is shown in Fig. 2 as minimum information and is identified with the reference mark 35.

With reference back to Fig. 1, now in a Step 155 in the centre 30 the route for the vehicle 20 including possible traffic disruptions is calculated.

If no disturbances, which can be relevant at the present moment or in the near future for the vehicle 20 are present, see no-branch in decision 160, a pre-branching to Step 175 is undertaken, in which the driving instructions from the on-board data calculated by the navigation device are output, until the destination is reached. In a Step 180 the procedure is ended. If, however, a traffic disturbance should be registered in the centre 30, which could be relevant for the planned trip of the vehicle 20 in the corresponding time-window, see yes-branch of decision 160, then a detour section for avoiding the disruption to traffic is calculated in the centre 30 and certain data defining the detour section of the disturbance is compiled for a transmission to the vehicle. This so-called delta data or delta information characterises the detour section so completely that the navigation system 25 on board the vehicle 20 can synthesise driving instructions to the driver, so that he can drive along the detour section.

The delta data is then transmitted to the vehicle 20 in a Step 170. The delta data is provided in Fig. 2 with a reference mark 40. The motor vehicle shown on the left or the right in Fig. 2 depicts one and the same vehicle. As it moves, however, between Step 150 and Step 170, see back to Fig. 1, two vehicles 20 are shown.

In a Step 175 the driving instructions, which the motor vehicle navigation system 25 has gleaned from the delta data 40, are output to the driver until the original route or the original destination of the trip is reached. It should be noted that the return to the original route, that is after the driving of the entire detour section, the vehicle navigation system directs the driver again completely autonomously and independent of the centre. Then in the further course of the route, the same or another central road

traffic centre can be linked again for a possible actualising of the section according to the same principle as represented in Fig. 1 and Fig. 2.

By way of additional reference to Fig. 3, which depicts a schematic street directory, the method will be described concretely in the following on the basis of a certain traffic situation according to a preferred embodiment.

A vehicle travels from the direction of Venlo in the direction of Hannover. The actual start and destination points are not relevant in this example.

The optimal route with the setting of the "quickest" route, leads from the freeway junction Duisburg-Kaiserberg via the A2. In the case of a complete blockage 50 of the A2 between Bottrop and Gelsenkirchen, a possible alternative route AR1 for an autonomous navigation device would be from the freeway junction Oberhausen over the A42 to the freeway junction Castrop-Rauxel and then via the A45 back on the A2.

The responsible central road traffic centre knows, however, that construction work 52 is being undertaken on the A42 before Castrop-Rauxel, which does not lead to blockages but could, under certain circumstances, lead to it due to the increased vehicle traffic. For this reason, certain delta information for an alternative route AR2 is transferred, from which the vehicle navigation system can, by means of reading and, if necessary, further evaluation of this information, suggest that the driver continue along an alternative route AR2 from the freeway junction Oberhausen via the A42 to the freeway junction Herne and then back via the A43 to Recklinghausen on the A2.

If there is already too much traffic on this section, a part could be directed as described and another part along an alternative route AR3 from the freeway junction Dortmund-West and then via the A45 back onto the A2, that is, not from the freeway junction Essen via the A43 to Recklinghausen, as the traffic near the construction site 52 and on the A43 between Herne and Recklinghausen would be too congested.

The more vehicles that are equipped with such systems, the more far-reaching, effective the extent a traffic guidance system through the centre would be.

Although the present invention has been described on the basis of a preferred embodiment, it is not limited to it, but can be modified in a host of ways.

For example, the data provided by the vehicle to the centre or by the centre to the vehicle can also be compromised according to a customary method in order to further reduce the amount of data to be transferred.

The method of the invention can be nested to various depths, for example in a nesting to a depth of two the delta data for one of the tertiary detour routes leading away from the main route can be passed through and processed for an already suggested secondary detour route.

The claims defining the invention are as follows:

1. A navigation method for use in vehicle navigation systems, said method including the steps of: calculating a route in a vehicle navigation system on board a vehicle; and transmitting information from a control centre to the vehicle navigation system for the purpose of planning an optimised route, wherein in the step of transmitting information from the control centre to the vehicle navigation system only delta information representing the required necessary deviations from a previously calculated route for driving an alternative section of the route is transmitted.

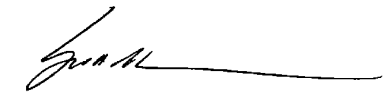
2. The method according to claim 1, further including the step of transmitting the current vehicle position, the destination of the route and the database version information to the control centre to initiate planning of an optimised route.

3. A vehicle navigation system, set up to implement the method according to any one of the preceding claims.

4. A navigation method for use in vehicle navigation systems, substantially as hereinbefore described with reference to the accompanying drawings.

Dated this 24th day of August, 2004

ROBERT BOSCH GMBH
By Their Patent Attorneys
CALLINAN LAWRIE



23/08/04,jfl 2420.spe,9

FIG 1

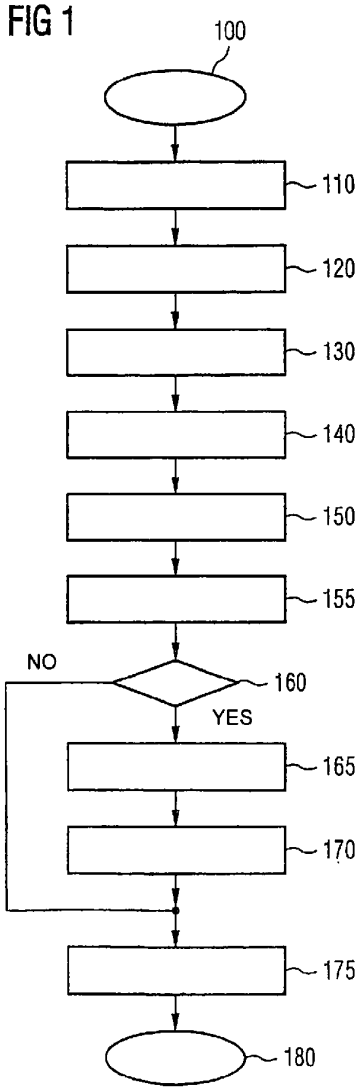


FIG 2

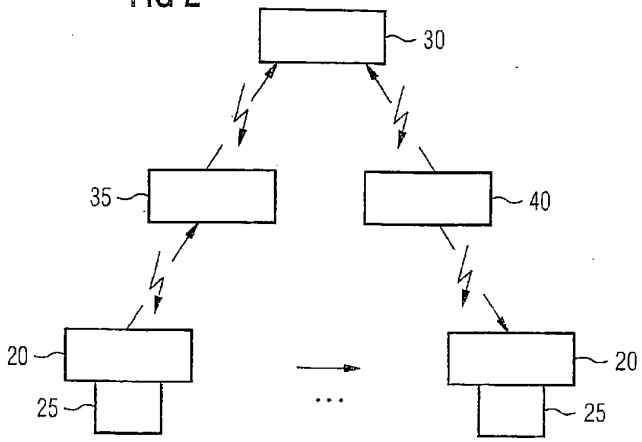
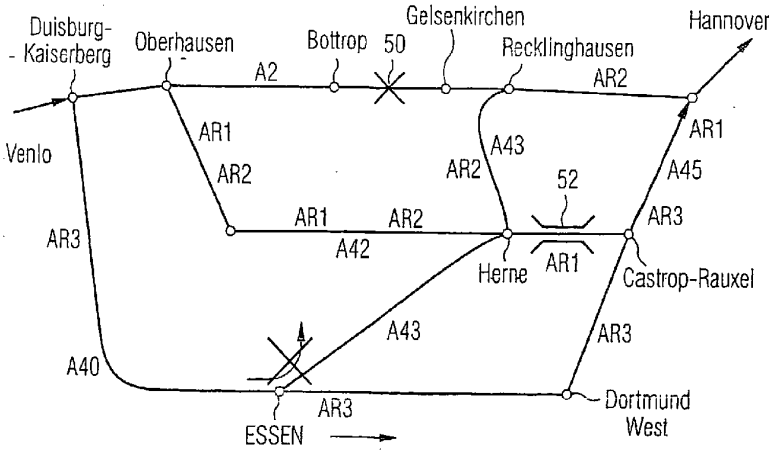

30
35
40
20
25
20
25

FIG 3


Duisburg-
- Kaiserberg
Oberhausen
Bottrop
50
Gelsenkirchen
Recklinghausen
Hannover
A2
AR2
Venlo
AR1
AR2
A43
AR2
AR1
A45
52
AR3
AR1
AR2
AR3
A42
Herne
AR1
Castrop-Rauxel
A43
AR3
A40
AR3
Dortmund
West
ESSEN