



March 26, 2024

Certification

Welocalize Translations

TRANSLATORS' DECLARATION:

We, Travis Huntsman, Lorelle Knowles, and Eric Vance hereby declare:

That we possess advanced knowledge of the Japanese and English languages. The attached Japanese into English translation has been translated by us and to the best of our knowledge and belief it is a true, correct and complete translation of: JPH10-221091A, JPH08-110230A and JP2007017351A. We hereby certify under penalty of perjury that the foregoing is true and correct.

A handwritten signature in cursive script, appearing to read "Travis Huntsman".

Travis Huntsman

Project Number: [Project # SUMI_2403_P0004] (JP2007017351A_Original_document_20240313113257)

A handwritten signature in cursive script, appearing to read "Lorelle Knowles".

Lorelle Knowles

Project Number: [Project # SUMI_2403_P0004] (L11031_04-6_JPH10-221091A)

A handwritten signature in cursive script, appearing to read "Eric Vance".

Eric Vance

Project Number: [Project # SUMI_2403_P0004] (L11031_04-7_JPH08-110230A)

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(54) [Title of Invention] NAVIGATION DEVICE

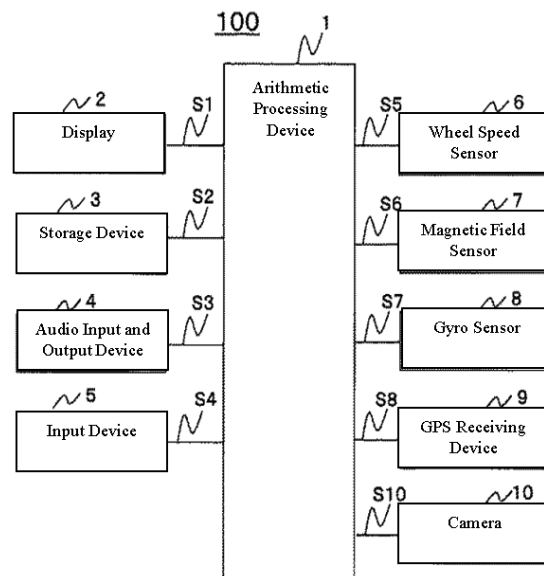
(57) [Abstract]

[Problem] The position of an object in a user field of view, not limited to the current position itself, is made to be the target of place registration.

[Resolution Means] A navigation device is provided with storage means for storing map data, an imaging device, means for displaying an image obtained by imaging, means for receiving designation of a point in the displayed image using a touch panel, registered place calculation means for finding a coordinate position on the map corresponding to the designated position, and means for registering the found position on the map. The registered place calculation means uses the position in the image of the designated point, the location on the map of the imaging device, and the imaging direction to find the coordinate position on the map of the designated point.

[Selected Drawing] FIG. 1

FIG. 1



[Scope of Patent Claims]

[Claim 1]

A navigation device comprising:

storage means for storing map data;

an imaging device;

display means for displaying an image obtained by imaging using the imaging device;

reception means for receiving a designation of a point in the image displayed by the display means;

registered place calculation means for finding a position on the map corresponding to the point received

by the reception means; and

place registration means for registering a position on the map found by the registered place calculation

means.

[Claim 2]

A navigation device, comprising:

storage means for storing map data;

an imaging device;

display means for displaying an image obtained by imaging using the imaging device;

reception means for receiving a point in the image displayed by the display means;

means for obtaining a position on a map and an imaging direction of the imaging device;

registered place calculation means for finding a position on a map corresponding to the point using a position in the image of the point received by the reception means, a position on a map of the imaging device, and an imaging direction; and

place registration means for registering the position on the map found by the registered place calculation

means.

[Claim 3]

The navigation device according to claim 2; comprising:

means for obtaining the current position and the vehicle direction of the vehicle to which the navigation device is mounted;

means for obtaining the installation position and installation direction of the imaging device on the vehicle;

means for finding the position on a map of the imaging device from the current position of the vehicle and the installation position of the imaging device on the vehicle; and

means for finding the imaging direction of the imaging device from the vehicle direction and the installation direction of the imaging device on the vehicle.

[Claim 4]

The navigation device according to claim 1 or 2, wherein

the reception means comprises a touch panel.

[Claim 5]

The navigation device according to claim 1 or 2, wherein

the place registration means registers the position on a map found by the registered place calculation means together with the image captured by the imaging device; and

the navigation device:

displays the registered image when displaying a map including the registered position.

[Detailed Description of Invention]

[Technical Field]

[0001]

The present invention relates to a navigation device, and particularly to an art of place registration for a onboard navigation device.

[Background Art]

[0002]

Patent document 1 teaches an onboard navigation device that registers any place on a map upon receiving instruction from the user, and displays the registered place on the map or makes it a candidate destination. The vehicle-onboard navigation device is provided with a current location calculation function and registers the current location of the vehicle when it receives a request for place registration.

[0003]

[Patent Document 1] Japanese Patent Application Publication No. H8-327373

[Disclosure of Invention]

[Problem to Be Solved by Invention]

[0004]

However, some users may want to register the position of a building or the like in the field of view of the user rather than the current location itself. Patent document 1 does not meet this need.

[0005]

An object of the present invention is to make the position of an object in a user field of view, not limited to the current position, to be the target of place registration.

[Means for Solving Problem]

[0006]

To resolve the above problem, the navigation device of the present invention finds and registers a coordinate position on the map for the designated point in the image captured by the imaging device.

[0007]

For example, the navigation device of the present invention is provided with: storage means for storing map data, an imaging device, display means for displaying an image obtained by imaging using the imaging device, reception means for receiving a designation of a point in the image displayed by the display means, registered place calculation means for finding a position on a map of the point received by the reception means, and place registration means for registering the position on a map found by the registered place calculation means.

[0008]

The registered place calculation means may use the position in the image of the point received by the reception means, the position on the map of the imaging device, and the imaging direction to find the position on the map corresponding to the point. Furthermore, the reception means may be provided with a touch panel.

[Best Modes For Carrying Out Invention]

[0009]

An embodiment of the present invention will be described below with reference to drawings.

[0010]

FIG. 1 is a schematic configuration diagram of an onboard navigation device 100. As illustrated in the drawings, the onboard navigation device 100 is provided with an arithmetic processing device 1, a display 2, a storage device 3, an audio input and output device 4, an input device 5, a wheel speed sensor 6, a magnetic field sensor 7, a gyro sensor 8, a GPS (global positioning system) receiving device 9, and a camera 10.

[0011]

The arithmetic processing device 1 is a central unit for performing various processing. For example, a current location is detected based on information output from the various sensors 6 to 8 or the GPS receiving device 9. Furthermore, map data required for display is read from the storage device 3 based on the obtained current location information. Furthermore, the read map data is graphically expanded and a mark indicating the current location is superimposed and displayed on the display 2 in this location. Furthermore, the map data stored in the storage device 3 is used to search for an optimal route (recommended route) connecting a destination instructed by the user and a current location (starting location). Furthermore, the audio input and output device 4 and display 2 are used to guide the user.

[0012]

The display 2 is a unit for displaying graphics information generated by the arithmetic processing device 1. The display 2 is configured by a CRT, liquid crystal display, or the like. A signal S1 between the arithmetic processing device 1 and the display 2 is generally connected via RGB signals or NTSC (National Television System Committee) signals.

[0013]

The storage device 3 is configured by a storage medium such as a CD-ROM, DVD-ROM, HDD, or IC card. Map data is also stored in this storage medium.

[0014]

The map data includes link data of each link configuring a road included in a mesh region, for each identification code of a mesh (mesh ID), which is a region drawn on the map. The link data includes, for each link ID, coordinate information of two nodes (start node and end node) configuring a link, type information of a road including a link, link length information indicating the length of the link, a link travel time, and a link ID (connection link ID) of the links connected to each of the two nodes.

[0015]

Furthermore, the map data also includes information (position, size, or the like) of map components (buildings, street trees, guard rails, or the like) other than the road included in the corresponding mesh region.

[0016]

The audio input and output device 4 converts a message to the user generated by the arithmetic processing device 1 to an audio signal and outputs this audio signal. Furthermore, processing is performed for recognizing a voice produced by the user and transferring the details thereof to the arithmetic processing device 1.

[0017]

The input device 5 is a unit for receiving instructions from the user. The input device 5 is configured by a touch panel installed on the front of the display 2. However, a hard switch such as a scroll key or scale change key, a joystick, or the like may be provided as the input device 5.

[0018]

The sensors 6 to 8 and the GPS receiving device 9 are used to detect the current location (position of the vehicle) using the onboard navigation device 100. The wheel speed sensor 6 measures a distance from the product of the circumference of the wheel and the measured wheel RPM, and measures the angle that a mobile body has turned from the difference between a pair of wheel RPM. The magnetic field sensor 7 detects the magnetic field of the earth and detects the direction that the mobile body is facing. The gyro 8 is configured by an optical fiber gyro, an oscillation gyro, or the like, and detects the angle that the mobile body has turned. The GPS receiving device 9 receives a signal from a GPS satellite and measures the distance between the mobile body and the GPS satellite and the rate of change in distance with respect to three or more satellites to measure the current position, travel speed, and travel direction of the mobile body.

[0019]

The camera 10 is an imaging device for acquiring an image of the periphery of the vehicle to which the onboard navigation device 100 is mounted. The camera 10 is configured by a small camera such as a CCD camera.

[0020]

FIG. 2 is a side view illustrating the installed state of the camera 10. The camera 10 is installed on an upper portion of a vehicle 88 via a support base 10s. The support base 10s can displace an imaging direction 10x of the camera 10 in the horizontal direction and the vertical direction (pan and tilt). The support base 10s is controlled by a stepping motor.

[0021]

FIG. 3 is a plane view illustrating the installed state of the camera 10. The installation position of the camera 10 with respect to the vehicle 88 is predetermined. Furthermore, the installation position of an antenna 91 of the GPS receiving device 9 with respect to the vehicle is predetermined. Information relating to the installation position of the GPS antenna 91 and the installation position of the camera 10 is preregistered, so the onboard navigation device 100 can find a coordinate position of the camera 10 on the map based on the current position (position of the GPS antenna) output by the GPS receiving device 9. Furthermore, the installation direction θb of the camera 10 with respect to the vehicle can be found by the rotation angle of the stepping motor of the support base 10s, so the onboard navigation device 100 can find the imaging direction 10x (in the drawings, θ is the reference direction N) of the camera 10 from the vehicle direction (in the drawings, θa is the reference direction N) and the installation direction θb of the camera 10 with respect to the vehicle. Note that a position that is similar

to the coordinate position of the GPS receiving device 9 may be used for the coordinate position of the camera 10.

[0022]

FIG. 4 is a functional block diagram of the arithmetic processing device 1.

[0023]

As illustrated in the drawings, the arithmetic processing device 1 is provided with a user operation analysis unit 41, a route search unit 42, a route guidance unit 43, a current position calculation unit 44, an information storage unit 45, a place registration unit 46, and a display processing unit 47.

[0024]

The user operation analysis unit 41 receives a request from the user, the request being input to the input device 5, analyzes the details of the request, and controls each unit of the arithmetic processing device 1 so that processing corresponding to the details of the request is performed. For example, when a place registration request has been received from the user, the place registration unit 46 is instructed so that processing relating to place registration is performed.

[0025]

The current position calculation unit 44 uses the distance data and angle data obtained as a result of integrating each distance pulse data S5 measured by the wheel speed sensor 6 and angular acceleration data S7 measured by the gyro 8 to integrate this data on the time axis, thereby periodically calculating a virtual current location (X', Y'), which is a position after travelling in the car from an initial position (X, Y). Furthermore, map match processing is performed on the virtual current position using map data, to make the current position match the road (link) that has the highest shape correlation.

[0026]

The route search unit 42 uses Dijkstra's algorithm or the like to find the route having the smallest cost (for example, travel time) of the route that connects the two designated places (current location and destination).

[0027]

The route guidance unit 43 performs route guidance using the route searched for by the route search unit 42.

[0028]

Information relating to the installation position of the GPS antenna and the installation position of the camera 10 is stored in advance in the information storage unit 45.

[0029]

The place registration unit 46 registers any place in the information storage unit 45 in accordance with user instructions. Furthermore, a coordinate position on the map is found in relation to a building or the like in the image captured by the camera 10 in accordance with user instructions, and the position thereof is registered.

[0030]

The display processing unit 47 generates a draw command for the information to be displayed on the display 2, and sends the generated command to the display 2. Furthermore, when a place registered in the range of the displayed map exists, information (for example, a flag mark) indicating that a registered place exists is displayed.

[0031]

FIG. 5 is a diagram illustrating a hardware configuration example of the arithmetic processing device 1.

[0032]

As illustrated in the drawings, the arithmetic processing device 1 is configured having each device connected via a bus 32. The arithmetic processing device 1 has a CPU (Central Processing Unit) 21 that performs various processing such as numerical calculations and controlling each device, a RAM (Random Access Memory) 22 that stores map data, calculation data, and the like read from the storage device 3, a ROM (Read Only Memory) 23 that stores programs and data, a DMA (Direct Memory Access) 24 that performs data transfer between memories and between a memory and each device, a drawing controller 25 that performs graphics drawing and performs display control, a VRAM (Video Random Access Memory) 26 that stores graphics image data, a color pallet 27 that converts image data to an RGB signal, an A/D converter 28 that converts analog signals to digital

signals, an SCI (Serial Communication Interface) 29 that converts a serial signal into a parallel signal synchronized with a bus, a PIO (Parallel Input/Output) 30 that synchronizes the parallel signal with the bus and puts it on the bus, a counter 31 that integrates pulse signals, and a camera control device 33 that sends control commands to the stepping motor of the camera 10 to control the imaging direction and converts analog signals obtained by imaging into image data.

[0033]

[Description of Actions] Next, the actions of the onboard navigation device 100 having the above configuration will be described.

[0034]

The onboard navigation device 100 of the present embodiment is provided with a function for registering any place on a map. This place registration function is not limited to registering the current position of the vehicle, and can also register a position of a building or the like in an image captured by the camera 10.

[0035]

FIG. 6 is a flow diagram illustrating the flow of such place registration processing.

[0036]

The user operation analysis unit 41 displays a captured image from the camera 10 on the display 2 via the display processing unit 47 when requested by the user to display the captured image from the camera 10 via the input device 5 (S10).

[0037]

FIG. 7 illustrates a display example of a captured image 510. In this manner, while displaying the captured image, the user operation analysis unit 41 receives any position on the captured image from the user via the input device 5. That is, monitoring is performed as to whether the designation of a point on the captured image has been received (S11). As described above, a touch panel is disposed on the front of the display 2 as the input device 5. When the touch panel is touched by the user, the user operation analysis unit 41 specifies a position on the captured image corresponding to the position on the touched panel. For example, in FIG. 7, the point Q is designated.

[0038]

When any position on the captured image is designated (Yes in S11), the place registration unit 46 finds a coordinate position (latitude and longitude) on the map corresponding to the designated point (S12).

[0039]

FIG. 8 and FIG. 9 are diagrams for describing a method for finding a coordinate position on a map of a designated point in a captured image. FIG. 8(a) is a side view and FIG. 8(b) illustrates the captured image 510. Furthermore, FIG. 9(a) is a plane view from a zenith direction, and FIG. 9(b) is the captured image 510.

[0040]

As illustrated in FIG. 8(a), the imaging direction (H-P2) of the camera 10 is slightly tilted toward a ground 503 as an elevation angle θ m. Note that it is assumed that the ground 503 is substantially horizontal. A field of view 502 of the camera 10 extends far having a camera position H as the center, and has a range P1-P3 on the ground 503. Furthermore, as illustrated in FIG. 9(a), the field of view 502 in the horizontal direction has a range P4-P6 on the ground 503. As illustrated in FIG. 8(b) and FIG. 9(b), the captured image 510 is an image in a plane of projection 501 orthogonal to the imaging direction (H-P2).

[0041]

When this is the case, as illustrated in FIG. 8, a coordinate position on the map of a lower-most positioned point p1 in the captured image 510 corresponds to a point P1. Furthermore, a coordinate position of an upper-most positioned point p3 in the captured image 510 corresponds to a point P3. Meanwhile, as illustrated in FIG. 9, a coordinate position of a left-most positioned point p4 in the captured image 510 corresponds to a point P4. Furthermore, a coordinate position of a right-most positioned point p6 in the captured image 510 corresponds to a point P6.

[0042]

The coordinate position on the map of a point Q in the captured image is an intersection q of the ground 503 and a line L connecting the camera position H and the point Q on the plane of projection 501. Therefore, it

is possible to find the position in map coordinates of a point in the captured image as long as the coordinate position and the imaging direction of the camera on the map are understood.

[0043]

Because the installation position of the camera 10 on the vehicle 88 is preregistered, the place registration unit 46 can find the coordinate position of the camera 10 on the map from the current position of the vehicle, the vehicle direction, and the installation position of the camera 10. Furthermore, as illustrated in FIG. 3, the imaging direction θ of the camera 10 can be found from the vehicle direction θ_a and the installation direction θ_b of the camera 10 established from the rotation angle of the stepping motor oriented toward the support base of the camera 10. The place registration unit 46 can find the coordinate position on the map of a designated point from the coordinate position on the map of the camera 10 found in this manner, the imaging direction θ , and the position of the designated point in the captured image.

[0044]

The description will continue returning to FIG. 6. Next, the place registration unit 46 registers the found position of the point. Specifically, as illustrated in FIG. 10, the place registration unit 46 generates registered place information 300 including information (registered place ID) 301 for identifying a registered place, a coordinate position (latitude and longitude) 302 of the designated point found in S12, registration date and time 303, and captured image 304, and registers this information in the information storage unit 45. Note that the registered captured image 304 may register a portion of the captured image 510 displayed on the display 2, having extracted an image around the designated point (for example, an image region at a prescribed distance from the designated point).

[0045]

Thereafter, the user operation analysis unit 41 returns to S10, displays the captured image again, and monitors for the existence of a place registration request (S11).

[0046]

This place registration processing ends when there is a request to stop displaying the captured image via the input device 5 from the user.

[0047]

In this manner, the registered place is used in various processing. For example, in the destination setting processing during a route search, registered places are listed up and displayed as candidate destinations. For example, these are listed up and displayed in the order of those having the most recent registered date and time.

[0048]

Furthermore, as illustrated in FIG. 11, when there is a registered place 602 in a map 601 displayed on a screen 600, the display processing unit 47 may acquire a registration image 304 of the registered place information 300 and display the acquired image 603. Note that when the captured image is a video, the video may be displayed.

[0049]

An embodiment of the present invention will be described below.

[0050]

According to the embodiment above, the designation of any point in an image captured by the camera is received, the coordinate position on the map of the received point is found, and this position is registered as a place. Therefore, instead of the current position of the vehicle, the position of a building or the like in the field of view of the user can be registered as a place. Furthermore, the user only has to designate the position to be registered as a place using the touch panel on the display, making operation simple.

[0051]

The present invention is not limited to the embodiment above. The embodiment above can be modified in various ways within the scope of the key points of the present invention.

[0052]

For example, the method for finding the coordinate position of the designated point in the captured image is not limited to the method illustrated in FIG. 8 and FIG. 9 described above. Specifically, the place registration unit 46 first finds the direction from the camera position to the object (for example, a building) corresponding to the point based on the position of the designated point in the captured image. Next, the camera is made to match

this direction, the focal point is made to match the object, the focal distance is measured, and a distance D from the camera to the object is found. Next, the coordinate position of the object on the map is found from the coordinate position of the camera on the map, the camera direction, and the found distance D to the object. Furthermore, a distance sensor may be provided to find the distance to the object.

[0053]

Moreover, when a building or the like in the image is designated by the user, the coordinate position on the map may be found using a lowest portion of the building (the point where the building meets the ground) as the designated point in S11. By doing so, even when a place on the ground is not designated, the place of a building to be registered by the user can be accurately registered. An example will be assumed wherein, when the user points to a telephone pole and attempts to register it as a place, an intermediate of the telephone pole on the image is designated on the touch panel. Buildings such as telephone poles have similar colors, so a range is defined having a related, similar color to the color of the point designated by the user, and an image region configuring the telephone pole is defined. The place registration unit 46 searches for a change in color in the downward direction for the defined image region, makes a place having the color of the ground (for example, on a road, black) the base of the telephone pole, and makes this place the place to be registered.

[0054]

Furthermore, the installation position of the camera on the vehicle is not limited to the position described above. The camera may also be installed on the side of the vehicle. Furthermore, in the embodiment above, the camera had variable imaging directions due to a rotating support base, but the imaging direction may be fixed.

[0055]

Moreover, in the embodiment above, a description was given wherein the present invention is applied to place registration in an onboard navigation device, but the present invention can also be applied in a measuring device for collecting map information. For example, when a new facility is constructed and the map data must be updated, the coordinate position of the facility must be understood. Conventionally, a person measures and finds the coordinate position of the facility. When the present invention is applied to a measuring device, the user can measure the coordinate position of a facility merely by designating the facility to be measured in the captured image.

[0056]

The configuration of such a measuring device is basically similar to the onboard navigation device 100 described above with the exception of not being provided with the route search unit 42 and the route guidance unit 43. The place registration unit 46 has the user designate a position of a facility to be measured in a captured image via an input device 5 such as a touch panel. The coordinate position of the position is found and registered in the information storage unit 45. Alternatively, the coordinate position is output to the display 2 according to requests from the user. By doing so, a measuring device is achieved that calculates a coordinate position merely by designating the position of a facility in a captured image. Note that the camera does not need to be oriented to the front, and may be oriented toward the rear, or the imaging direction may be freely changed according to requests from the user.

[Brief Description of Drawings]

[0057]

[FIG. 1] FIG. 1 is a schematic configuration diagram of an onboard navigation device.

[FIG. 2] FIG. 2 is a diagram for describing the installation position of a camera.

[FIG. 3] FIG. 3 is a diagram for describing the installation position of a camera.

[FIG. 4] FIG. 4 is a diagram illustrating the functional configuration of an arithmetic processing device 1.

[FIG. 5] FIG. 5 is a diagram illustrating the hardware configuration of the arithmetic processing device 1.

[FIG. 6] FIG. 6 is a flow diagram of place registration processing.

[FIG. 7] FIG. 7 is a display example of a captured image.

[FIG. 8] FIG. 8 is a diagram for describing a method for finding a coordinate position of a point in an image on a map.

[FIG. 9] FIG. 9 is a diagram for describing a method for finding a coordinate position on a map of a point in an image.

[FIG. 10] FIG. 10 is a configuration example of registered place information.

[FIG. 11] FIG. 11 is a display example of a registered place.

[Description of Reference Numerals]

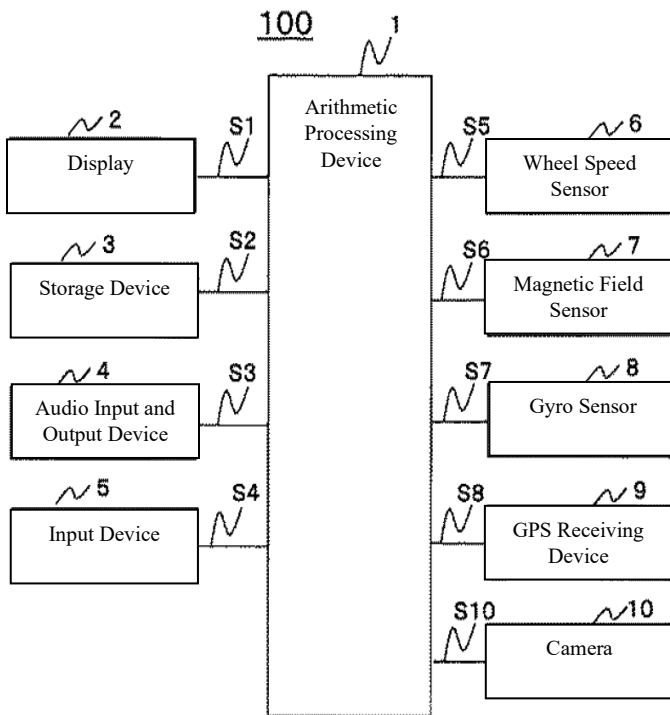
[0058]

100... Onboard navigation device,

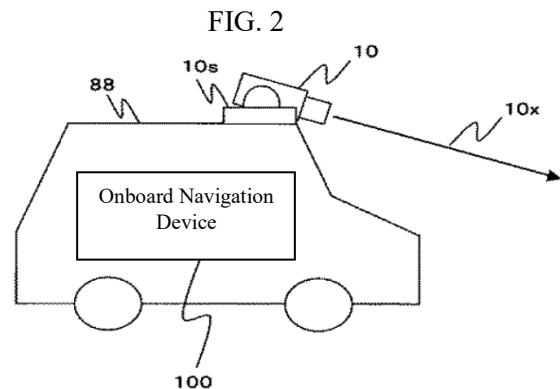
1... arithmetic processing device, 2... display, 3... storage device, 4... audio output and input device, 5... input device, 6... wheel speed sensor, 7... magnetic field sensor, 8... gyro, 9... GPS receiver, 10... camera, 21... CPU, 22... RAM, 23... ROM, 24... DMA, 25... drawing controller, 26... VRAM, 27... color pallet, 28... A/D converter, 29... SCI, 30... PIO, 31... counter, 33... camera control device, 41... user operation analysis unit, 42... route search unit, 43... route guidance unit, 44... current position calculation unit, 45... information storage unit, 46... place registration unit, 47... display processing unit

[FIG 1]

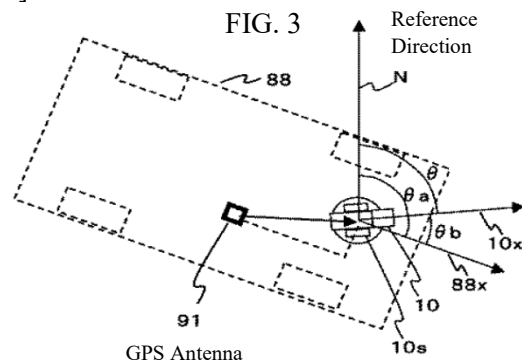
FIG. 1



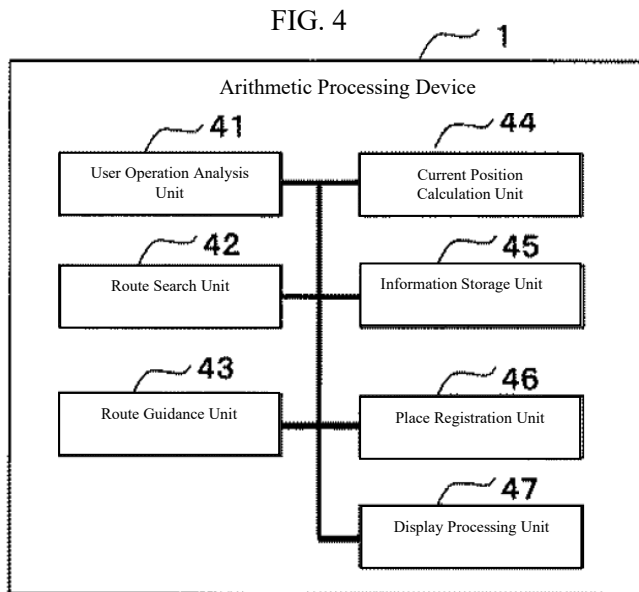
[FIG 2]



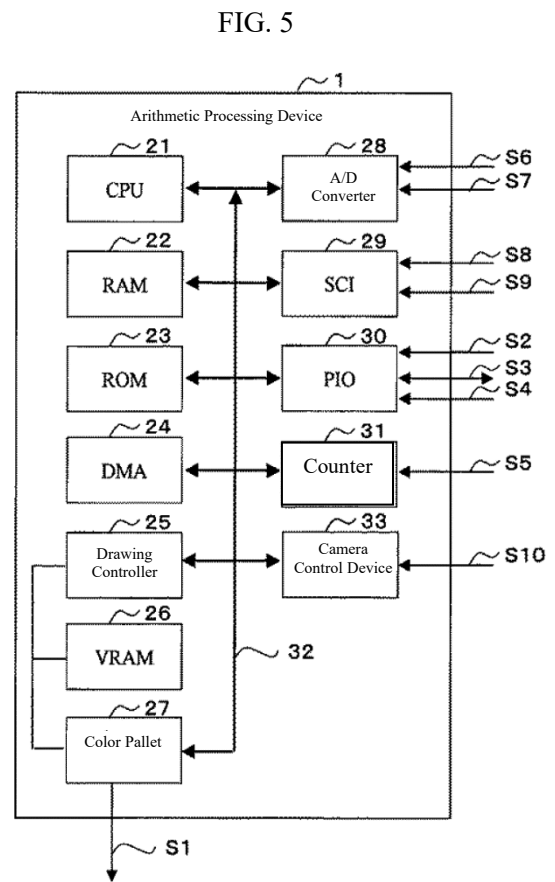
[FIG 3]



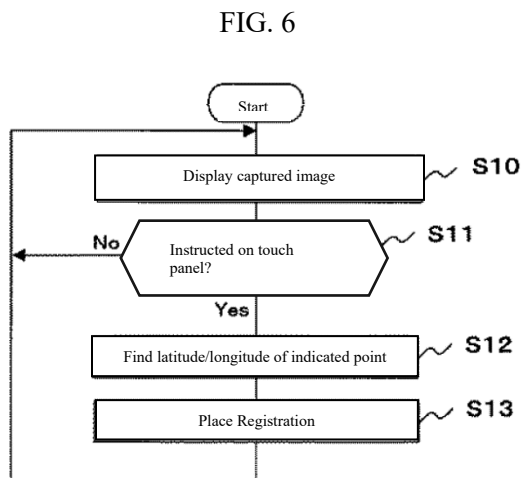
[FIG] 4



[FIG 5]

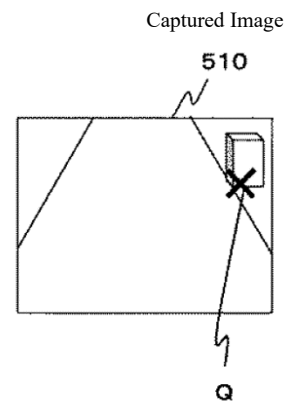


[FIG 6]



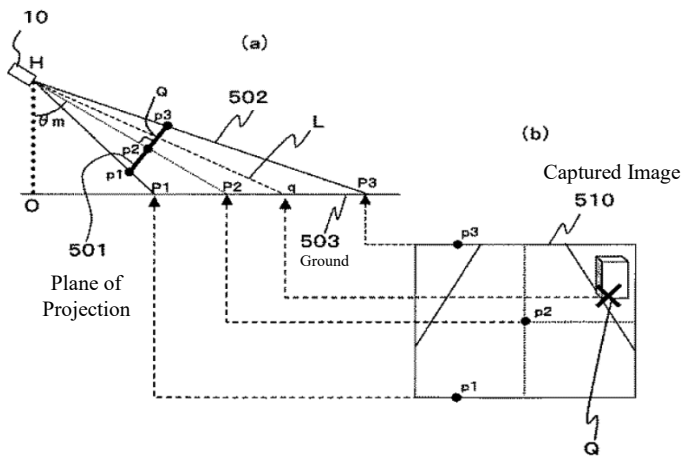
[FIG 7]

FIG. 7



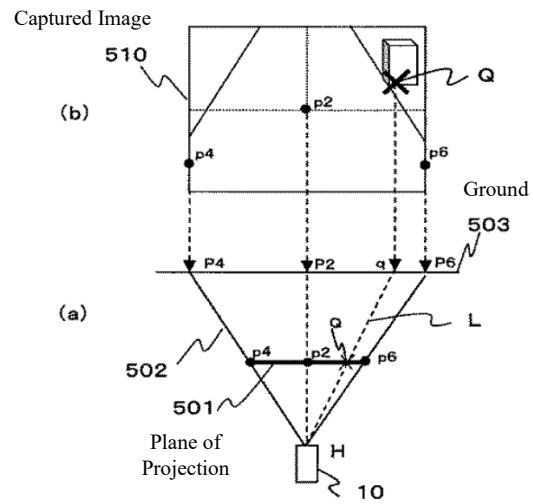
[FIG 8]

FIG. 8



[FIG 9]

FIG. 9



[FIG 10]

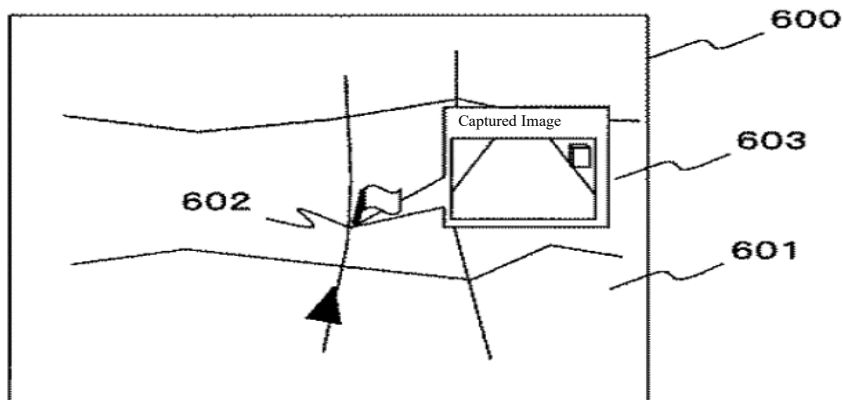
FIG. 10

Registration Place Information 300

301	302	303	304
Registered Place ID	Latitude/Longitude	Registration Date and Time	Captured Image

[FIG 11]

FIG. 11



(12)

JP 2007-17351 (P2007-17351A)

F Term (Reference)	2F129	AA03	BB03	BB19	BB20	BB21	BB22	CC03	CC07	CC15	CC33
		DD03	DD63	EE02	EE11	EE13	EE23	EE43	GG17	HH02	HH05
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		FF33									