Appeal decision

Appeal No. 2018-4971

U.S.A.
Appellant The Boeing Company

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Appellant The University of Tokyo

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The case of appeal against the examiner's decision of refusal of Japanese Patent Application No. 2012-174392, entitled "Image Based Position Determination" [the application published on February 28, 2013, Japanese Unexamined Patent Application Publication No. 2013-40932, number of claims (15)] has resulted in the following appeal decision.

Conclusion

The examiner's decision is revoked.

The Invention of the present application shall be granted a patent.

Reason

No. 1 History of the procedures

The application relating to this case (the present application) is an application in foreign language filed on August 6, 2012 claiming priority under the Paris Convention based on a patent application which was filed on August 9, 2011 in the United States of America. Then, the translation of the foreign language document was submitted on September 27, 2012, and amendment to the scope of claims for patent (hereinafter, referred to as "Primary Amendment") was made on July 1, 2016. Furthermore, although amendment to the scope of claims for patent (hereinafter, referred to as "Secondary Amendment") was made on June 1, 2017, the Secondary Amendment was dismissed by

a decision dated November 30, 2017 (hereinafter, referred to as "Decision to dismiss the amendment"), and the examiner's decision of refusal (examiner's decision) was issued on the same day. A certified copy of the examiner's decision was delivered on December 12, 2017.

Against this, the appellant demanded an appeal against the examiner's decision of refusal on April 11, 2018, and amendment to the scope of claims for patent (hereinafter, referred to as "Amendment as of the demand for appeal") was made at the same time.

The body issued a notice of the reason for refusal (hereinafter, referred to as "Reasons for refusal by the body") on January 17, 2019 (dispatch date of a notice of reasons for refusal: January 22, 2019), and the appellant made amendment to the scope of claims for patent (hereinafter, referred to as "the Amendment") and submitted a written opinion on April 19, 2019.

No. 2 The invention according to the present application

The inventions according to Claim 1 to Claim 15 of the scope of claims of the present application (hereinafter, referred to as "Invention 1" to "Invention 15") are specified by matters described in Claim 1 to Claim 15 after the Amendment of the case as follows.

"[Claim 1]

A method for identifying a position of a platform selected from an aircraft and a robotic manipulator, comprising:

identifying a first location of features in a first image in a series of images generated by a camera system on the platform while the platform is moving;

identifying a second location of features in a second image taken at a different time from the first image in the series of the images generated by the camera system on the platform while the platform is moving;

determining whether or not the features are moving in an environment in a view field of the camera system;

identifying difference between the first location of the features in the first image and the second location of the features in the second image;

identifying shift in a perspective of the camera system from the difference between the first location of the features in the first image in the series of the images and the second location of the features in the second image in the series of the images; and

identifying a change in the position of the platform based on the shift in the perspective, in response to the determination that the features do not move in the environment in the view field of the camera system,

wherein identifying the first location of the features in the first image in the series of images, comprises receiving a current image of the series of the images from the camera system; and

identifying a plurality of first locations in an image frame of the camera system, each of the plurality of first locations corresponding to the features in the current image of the series of the images,

wherein identifying the second location of the features in the second image of the series of the images, comprises identifying a plurality of second locations in the image frame, each of the plurality of second locations corresponding to the feature in a previous image of the series of the images,

wherein identifying the difference comprises selecting the first location from the plurality of identified first locations based on an operation state of the platform and at least one of the positions of the features and past movement of the features; and

identifying the difference by using the selected first location and the second location corresponding to the same feature part as a feature part in the selected first location.

[Claim 2]

The method of Claim 1, further comprising identifying a current position of the platform based on the change in the position of the platform.

[Claim 3]

The method of Claim 2, wherein identifying the current position of the platform comprises identifying the current position of the platform based on the change in the position of the platform and a starting position of the platform.

[Claim 4]

The method of Claim 2, further comprising controlling movement of the platform based on the current position of the platform.

[Claim 5]

The method of Claim 1, wherein the position of the platform comprises a location of the platform in a three-dimensional coordinate system and an orientation of the platform in the three-dimensional coordinate system.

[Claim 6]

The method of Claim 1, wherein identifying the first location of the features in the first image comprises identifying first pixels in the first image corresponding to the features in the environment in a view field of the camera system; and

identifying the second location of the features in the second image corresponding to the features in the environment in a view field of the camera system.

[Claim 7]

The method of Claim 1, wherein the platform is a robotic manipulator and the camera system is attached to the robotic manipulator.

[Claim 8]

An apparatus comprising:

a camera system configured to generate a series of images and installed on a platform selected from an aircraft and a robotic manipulator; and

a position calculator configured to identify a first location of features in a first image in the series of images generated by the camera system on the platform while the platform is moving, to identify a second location of features in a second image taken at a different time from the first image in the series of the images generated by the camera system on the platform while the platform is moving, to determine whether or not the features are moving in an environment in a view field of the camera system, to identify difference between the first location of the features in the first image and the second location of the features in the second image, to identify shift in a perspective of the camera system from the difference between the first location of the features in the first image in the series of the images and the second location of the features in the second image in the series of the images, and to identify a change in the position of the platform based on the shift in the perspective, in response to the determination that the features are not moving in the environment in the view field of the camera system,

wherein the position calculator is configured to receive a current image of the series of the images from the camera system,

to identify the plurality of first locations in an image frame of the camera system, each of the plurality of first locations corresponding to one of the features in the current image of the series of the images,

to identify the plurality of second locations in an image frame, each of the plurality of second locations corresponding to one of the features in a previous image of the series of images,

to select the first location from the plurality of identified first location based on an operation state of the platform and at least one of the positions of the features and past movement of the features, and

to identify the difference by using the selected first location and the second location corresponding to the same feature part as a feature part in the selected first location.

[Claim 9]

The apparatus of Claim 8, wherein the position calculator is further configured to identify a current position of the platform based on the change in the position of the platform.

[Claim 10]

The apparatus of Claim 9, wherein the position calculator is configured to identify the current position of the camera system based on the change in the position of the platform and a starting position of the platform.

[Claim 11]

The apparatus of Claim 8, wherein the position of the platform comprises a location of the platform in a three-dimensional coordinate system and an orientation of the platform in the three-dimensional coordinate system.

[Claim 12]

The apparatus of Claim 8, wherein the position calculator is configured to identify first pixels in the first image corresponding to the features in the environment in the view field of the camera system, and

to identify second pixels in the second image corresponding to the features in the environment in the view field of the camera system.

[Claim 13]

The apparatus of Claim 8, further comprising a housing, wherein the camera system and the position calculator are contained in the housing; and

a mounting structure configured to attach the housing to the platform.

[Claim 14]

The apparatus of Claim 13, wherein the mounting structure is configured to attach the housing to the platform.

[Claim 15]

The apparatus of Claim 8, wherein the camera system comprises a camera having a frame rate of at least approximately one hundred frames per second."

Invention 2 to Invention 7 include all constitutions of Invention 1.

Further, Invention 8 is the invention of an apparatus performing a method according to Invention 1, and is an invention that is different in just category expression. Then, Invention 9 to Invention 15 include all constitutions of Invention 8.

No. 3 Outline of Decision to Dismiss the Amendment

In relation to Secondary Amendment to aim at the restriction of the scope of claims stipulated in Article 17-2(5)(ii) of the Patent Act, each of the inventions according to Claim 1 to Claim 15 after Secondary Amendment must be one which should be independently patentable at the time of the patent application.

However, the inventions according to Claim 1 to Claim 15 after Secondary Amendment could have been easily invented by a person skilled in the art based on the inventions described in Cited Document 1 to Cited Document 6, and should not be granted a patent for it independently at the time of patent application under the provisions of Article 29(2) of the Patent Act.

Therefore, the Secondary Amendment violates the provision of Article 126(7) of the Patent Act which is applied mutatis mutandis in the provisions of Article 17-2(6) of the Patent Act, and shall be dismissed under the provisions of Article 53(1) of the Patent Act.

Cited Document 1: National Publication of International Patent Application No. 2008-527854

Cited Document 2: Japanese Unexamined Patent Application Publication No. 2008-60874

Cited Document 3: Japanese Unexamined Patent Application Publication No. 2008-249688

Cited Document 4: Japanese Unexamined Patent Application Publication No. 2005-250989

Cited Document 5: Japanese Unexamined Patent Application Publication No. 2010-286926

Cited Document 6: Japanese Unexamined Patent Application Publication No. 2009-163357

No. 4 Outline of the examiner's decision

1 Reason 1 (new matter)

The matters "identifying the number of first pixels in the first image" and "identifying the number of second pixels in the second image" that are described in Claim 7 after Primary Amendment are not described in the translation of the foreign language document.

Therefore, the Primary Amendment is not made within the scope of the matters stated in the translation of the foreign language document, and thus does not meet the requirement stipulated in Article 17-2(3) of the Patent Act.

2 Reason 2 (clarity)

In Claim 19 after Primary Amendment, it is described that "a platform is selected from platforms including an aircraft and a robotic manipulator." However, what is included in "platforms including an aircraft and a robotic manipulator" other than "an aircraft" and "a robotic manipulator" is unknown, and the scope of "platforms" is unknown. Then, the scope of "a platform" selected from those is also unknown, and consequently, the invention according to Claim 19 after Primary Amendment is not clear.

Therefore, the description of the scope of claims of the present application does not meet the requirement stipulated in Article 36(6)(ii) of the Patent Act.

3 Reason 3 (inventive step)

The inventions according to Claim 1 to Claim 20 after Primary Amendment could have been easily invented by a person skilled in the art based on the inventions described in Cited Document 1 to Cited Document 3, and should not be granted a patent for them independently at the time of patent application under the provisions of Article 29(2) of the Patent Act.

Cited Document 1: National Publication of International Patent Application No. 2008-527854 (mentioned above)
Cited Document 2: Japanese Unexamined Patent Application Publication No. 2008-60874 (mentioned above)
Cited Document 3: Japanese Unexamined Patent Application Publication No. 2005-249688 (mentioned above)

No. 5 Outline of Reasons for Refusal by the Body (clarity)

In Claim 1 after Amendment as of the demand for appeal, there is a description "identifying a plurality of first locations in an image frame of the camera system based on an operation state of the platform, each of the plurality of first locations corresponding to the feature in the current image of the series of the images," and it is considered that "identifying a plurality of first locations (corresponding to the feature in the current image of the series of the images) in an image frame of the camera system" is "based on an operation state of the platform."

However, it is not clear how "based on an operation state of the platform" specifies identifying locations corresponding to the features in the image, which are described in [0045], [0046], [0101] and [0104] of the specification.

The description of Claim 8 after Amendment as of the demand for appeal is the same.

Therefore, the inventions according to Claim 1 and Claim 8 after Amendment as of the demand for appeal are not clear. The inventions according to Claim 2 to Claim 7 and Claim 9 to Claim 15 after Amendment as of the demand for appeal which are described by directly or indirectly citing the description of Claim 1 or Claim 8 after Amendment as of the demand for appeal are the same.

Therefore, the scope of claims of the present application does not meet the requirement stipulated in Article 36(6)(ii) of the Patent Act.

No. 6 Regarding Reasons for Refusal by the Body (clarity)

By the Amendment, Claim 1 was to describe "selecting the first location from the plurality of identified first locations based on an operation state of the platform and at least one of the positions of the features and past movement of the features." Hence, it became clear that "based on an operation state of the platform" specifies "selecting the first location from the plurality of identified first locations," and thus the invention according to Claim 1 after the Amendment (Invention 1) became clear.

Further, by the Amendment, Claim 8 was to describe "to select the first location from the plurality of identified first locations based on an operation state of the platform and at least one of the positions of the features and past movement of the features," and hence, the invention according to Claim 8 after the Amendment (Invention 8) also became clear.

The inventions according to Claim 2 to Claim 7 and Claim 9 to Claim 15 after the Amendment which are described by directly or indirectly citing the description of Claim 1 or Claim 8 after the Amendment (Invention 2 to Invention 7 and Invention 9 and Invention 15) are the same.

Therefore, the reasons for refusal stated by the body were resolved.

No. 7 Regarding Reason 1 (new matter) and Reason 2 (clarity) of the examiner's decision 1 Reason 1 (new matter)

By Amendment as of the demand for appeal, Claim 6 (corresponding to Claim 7 after Primary Amendment) was to describe the matters "identifying first pixels of the first image" and "identifying second pixels of the second image." This point is the same after

the Amendment. Hence, the amendment was made within the scope of the matters described in the translation of a document written in foreign language.

Therefore, Reason 1 of the examiner's decision cannot be maintained.

2 Reason 2 (clarity)

By Amendment as of the demand for appeal, Claim 14 (corresponding to Claim 19 after Primary Amendment) was to delete the description "a platform is selected from the platforms including an aircraft and a robotic manipulator," and Claim 8 (corresponding to Claim 11 after Primary Amendment) was to describe "a platform selected from an aircraft and a manipulator." This point is the same after the Amendment. Hence, "a platform" of the invention according to Claim 8 after the Amendment (Invention 8) is specified as "an aircraft" or "a robotic manipulator." Since "a platform" of Claim 14 after the Amendment which was described by indirectly citing the description of Claim 8 after the Amendment (Invention 14) is the same, the scope thereof is clear and Invention 14 is clear.

Therefore, Reason 2 of the examiner's decision cannot be maintained.

No. 8 Regarding Reason 3 (inventive step) of the examiner's decision

1 The invention and the like described in Cited Document

(1) Cited Document 1

A Description of Cited Document 1

In Cited Document 1, the following matters are described. Underlines were provided by the body.

"[0019]

Referring to FIG. 1, a system is described in which the optical flow of a sequence of images from a camera embedded in a handheld entertainment device, such as a camera phone 100, is used to determine the motion of the handheld device as a means, for example, of controlling a game or application. The camera phone 100 includes a user interface 110 configured to allow a user to interact with the device. The user interface 110 includes, for example, a display interface 111, a keypad 112, a microphone 113, and a speaker 114. The display interface 111 provides a visual display to the user, which may indicate information regarding the status of the camera phone or provide a visual interface for an application, such as a game configured to execute on the camera phone. The keypad 112 includes a group of buttons or pressure activated switches that a user can activate to provide an input to the camera phone. The microphone 113 accepts an

audible input from a user and may be configured to transmit the audible input to another device using the telephone system or determine a user input based on the user's audible input. The speaker 114 produces an audible output to a user and may be configured to produce an audible output of a communication over the telephone system or produce an audible output to indicate information regarding the status of the camera phone (e.g., produce a sound to indicate acceptance of a user input). A processor (not shown) is configured to accept input from each portion of the user interface 110, perform a function or operation based of the user input, and render a display on the display interface 111 and/or produce sound from the speaker 114 in response to the user input when appropriate.
[0020]

The camera phone 100 also includes a camera 120. The camera 120 has a lens 121 for focusing an image and is capable of capturing a digital representation of the image focused by the lens 121. Although FIG. 1 depicts the camera 120 at the top of the camera phone 100 and facing the user when the user is viewing the display interface 111, the camera 120 may be located on the camera phone in a variety of positions and orientations. For example, the camera 120 may be located at the top of the camera phone 100 and facing away from the user when the user is viewing the display interface 111. The camera 120 may be configured to capture a series of images over time, as the camera phone 100 is moving. The processor (not shown) may accept the series of images and perform processing on the series of images to determine a description of motion of the camera phone 100. Based on the determined motion, the processor may determine a user input to an application that corresponds to the determined motion of the camera phone 100. For example, if the processor determines that the user rotated the camera phone 100 to the left, the processor may determine that the user wishes to take a particular action and, if the processor determines that the user rotated the camera phone 100 to the right, the processor may determine the user does not wish to take a particular action. In another implementation, the processor may use the determined motion as a user input to a game executing on the camera phone 100. For example, rotating the camera phone 100 to the left may cause an object displayed in a game to move to the left and rotating the camera phone 100 to the right may cause an object displayed in a game to move to the right.
[0021]

One technique the processor of the camera phone 100 may use to determine a description of motion of a camera based on images captured as the camera is moving is known as optical flow. Optical flow describes the apparent relative velocity of features within a sequence of images. The sequence of images may be acquired from a single

camera, allowing optical flow to be used without special camera hardware or calibration. Traditionally, optical flow is used for applications such as time interpolation of image sequences (inserting frames in movies) and 3D object reconstruction research."

"[0037]

Fig. 6 is a flowchart of an a process 600 for determining a description of motion of a device to determine a user input to an application. In one implementation, a processor on a handheld entertainment apparatus with a camera affixed (such as camera phone 100, or PDA or other mobile device equipped with a camera) may perform process 600, and measurement of the rotation of the camera's field of view may be used to control a game or application running on the handheld entertainment apparatus. The measurement of rotation may be used to provide an input that is analogous to a tilt sensor. Further, because both the direction and magnitude of tilt can be measured, "analog" control may be provided. Analog controls tend to provide finer control and are preferable to "digital" control for many styles of gameplay.

[0038]

In implementing process 600 shown in FIG. 6, a moving mobile camera captures images (610). Capturing images (610) may include, for example, capturing a digital representation of a series of images over a period of time during motion of the camera.

[0039]

A processor determines a description of motion of the camera based on the captured images (620). The processor, for example, may compare the most recently acquired image with images acquired earlier in time to determine the change in position of stationary features in the series of images to estimate the motion of the camera. The processor may utilize an optical flow process discussed above. Determining a description of motion 620 is discussed in more detail with respect to FIG. 7."

"[0042]

In one example, an application may use the camera orientation to replicate a tilt sensor function. The tilt sensor function may be used in controlling a ball in a game, including simulating the tilt of a plane on which the ball rolls. In another example, an application may use the camera orientation to replicate a steering function. The steering function may be used in controlling a vehicle (e.g., automobile, motorcycle, airplane, watercraft, surfboard, snowboard, skateboard, hover board, space craft). The steering function may include control of one or more of steering-direction, pitch, yaw, or roll. In yet another example, an application may use the camera orientation to replicate a targeting

(aiming) function. The targeting or aiming function may be used in controlling a virtual weapon (e.g., aiming a rifle). The targeting (aiming) function typically includes two degrees of freedom, hi addition, an application may use a sub-set of features that have been classified as moving objects, as described below. This may be used to augment a targeting (aiming) application (e.g., a moving object or feature may be designated as a target and the objective of the game may be to aim the device so that the moving object or feature is located in the center of the screen within displayed crosshairs). An application, for instance, may also use the camera orientation to replicate an absolute positioning function. The absolute positioning function may be used in a navigational application (e.g., tracking a user's position in a real world environment to help the user navigate through the environment, such as a store or shopping mall) or maze game (e.g., a user walks through a virtual maze by walking around in the real world). The motions required may be those performed by the hands, or may require that the user move about in an environment."

"[0045]

FIG. 7 is a flowchart of a process 700 of using optical flow to determine a description of motion of a moving camera. Although a dense flow field algorithm may be used, camera motion can be described in six degrees of freedom, and under the intended application approximated with fewer degrees of freedom. Therefore, a well-distributed sparse set of features is sufficient for detecting or estimating camera motion in varying degrees of freedom and may be used to reduce the processing load. With the decreased processing load, images may be captured and processed in real time in certain implementations.

[0046]

In one implementation, a well-distributed sparse set of features is sufficient for estimating camera motion in six degrees of freedom. In sparse optical flow, a flow vector may be generated only for visually distinctive features within the image. These features may be scattered throughout the image. In a well-distributed set of features, the features are distributed throughout the entire image such that there is at least one feature within each region of the image (as opposed to, for example, all the features appearing in a clump in one corner of the image). Therefore, a dense flow field is not required to describe the motion in all regions of the image, a sparse set can do the same if the features are well-distributed."

"[0049]

Process 700 includes extracting features (710). In analyzing a series of images captured from a moving mobile camera, a feature extraction process is applied to each image that is acquired by the camera. The feature extraction process need only extract a sparse set of features from an arbitrary image. The features sought after typically include corners and edges. Comers and edges are commonly found in many environments where a device will typically be operated. Corners and edges are fairly resilient to dynamic light levels, which may be important if the device is operated outdoors. Furthermore, corner and edge features are relatively computationally inexpensive to detect in an image. Methods of exacting corners and edges are well known.
[0050]

After extracting features, process 700 compares images to match features common to more than one image (720). For example, a flow-field calculating process matches features of the current camera image to corresponding features of a previous camera image. To match features, each feature of the current camera image is compared to a sub-set of the features of a previous camera frame. The sub-set is selected by proximity and feature characteristics (e.g., orientation and contrast of the corner). The small number of features that need to be compared in particular implementations helps minimize the computational requirements of the device."

"[0053]

After matching features, process 700 determines a flow vector for each feature (730). One implementation determines the flow vector by calculating the displacement of the position of a feature in the current camera image relative to its position in a previous camera image. The set of flow vectors forms the flow field. Each flow vector may include a magnitude and a direction. The matched pairs produce an overall path of a feature's position between the two associated camera images. The path is optionally stored, so that the optical flow (and therefore camera motion) can be calculated across longer time spans.
[0054]

Because the environment cannot be guaranteed to be static, and moving features may result in an inaccurate estimation of motion, features may optionally be segmented (740). The dashed box of operation 740 in FIG. 7 indicates that operation 740 is optional. In one implementation, features are segmented into "sets" or "clusters" to generate a set of flow vectors associated with the static elements of the environment (i.e. the background). For example, if a bird is flying across an image in the same direction as the motion of the camera, the feature representing the bird may not show a displacement

in as great a magnitude as stationary features or may show a displacement in the opposite direction if the bird is moving faster than the camera. Thus, segmenting the feature representing the bird and focusing on the stationary features may allow for a more accurate determination of motion of the camera."

"[0058]

Process 700 determines the motion of the camera (750). The motion of the camera may be determined using an optical flow field comprising optical flow vectors for each feature matched in a series of images and not segmented out. The motion of the camera may be calculated from the apparent velocities of features in the camera view represented by optical flow vectors. The magnitude and direction of the flow vectors for stationary features are related to the motion of the camera and may be used to estimate the motion of the camera."

"[0062]

Process 700 optionally calculates cumulative motion of the camera (760). The dashed box of operation 760 in FIG. 7 indicates that the operation is optional. The cumulative motion may be calculated by tracking the determined motion of the camera. The cumulative motion of a sequence of camera images may be calculated to determine the device's position relative to an initial position. However, errors may compound relatively quickly from image to image."

[FIG. 1]

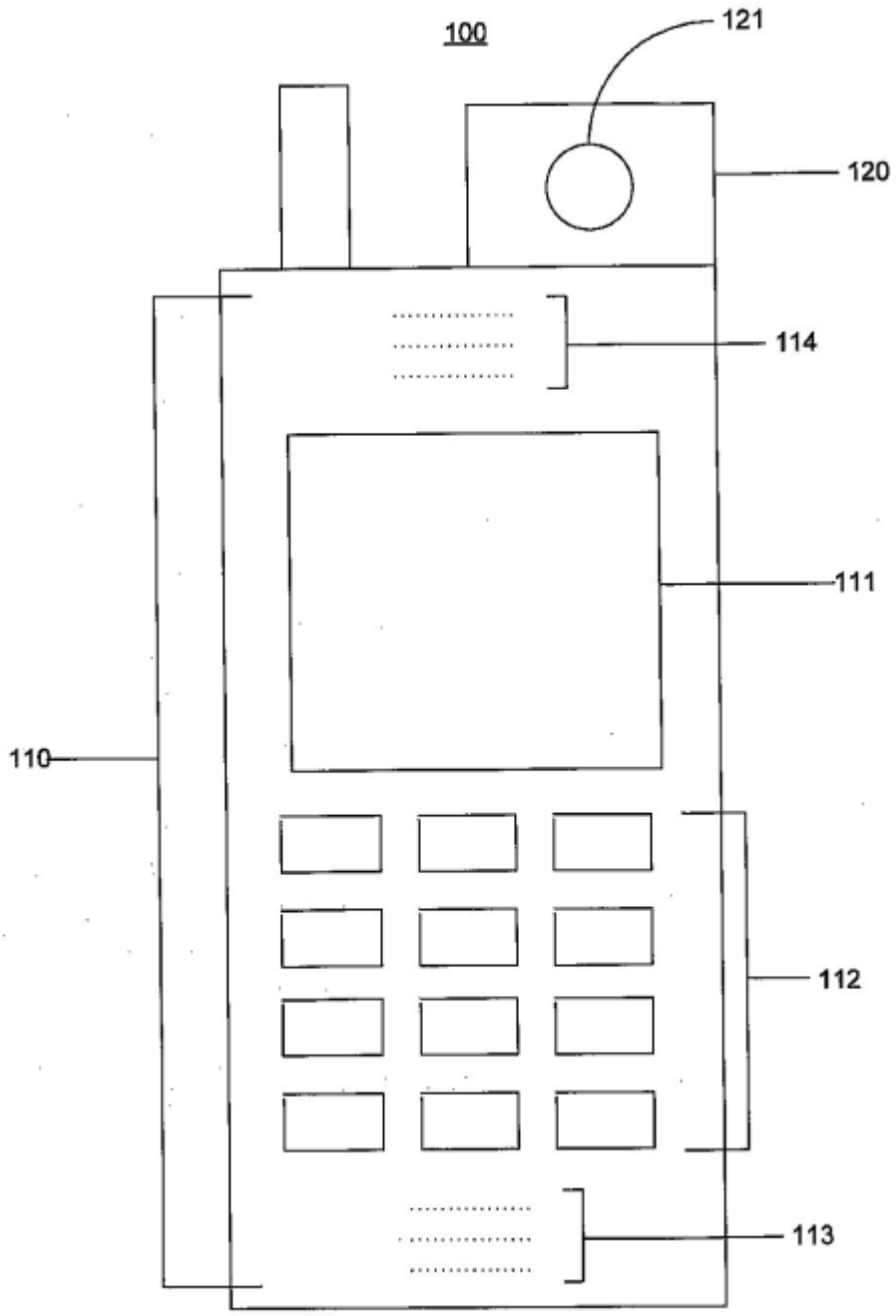

FIG. 1

[FIG. 6]

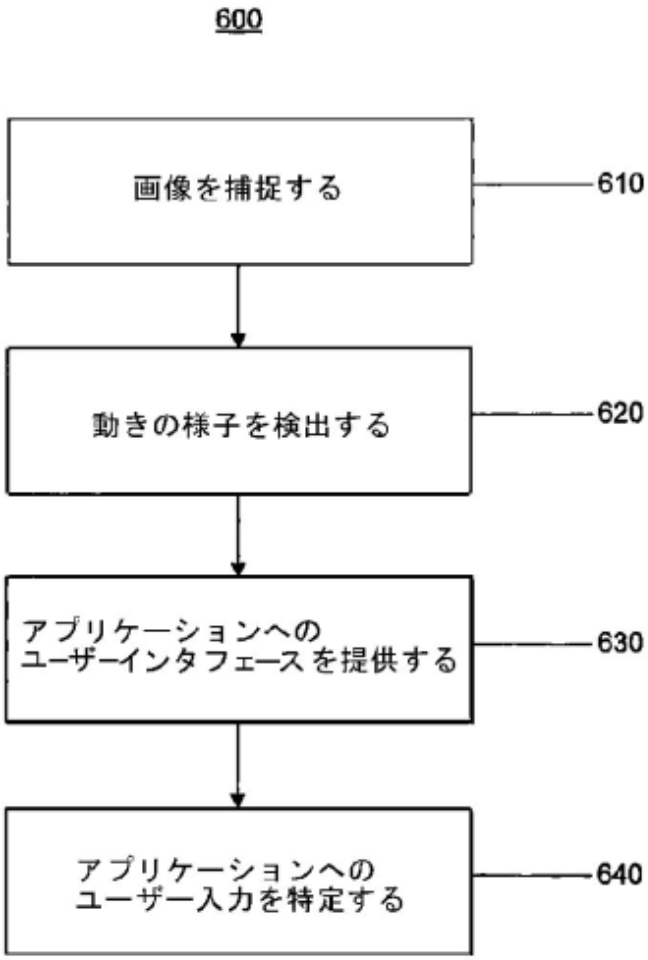

FIG. 6

画像を捕捉する Capture Images
動きの様子を検出する Determine Description of Motion
アプリケーションへのユーザーインターフェースを提供する Provide User Interface To An Application
アプリケーションへのユーザー入力を特定する Determine A User Input To The Application

[FIG. 7]

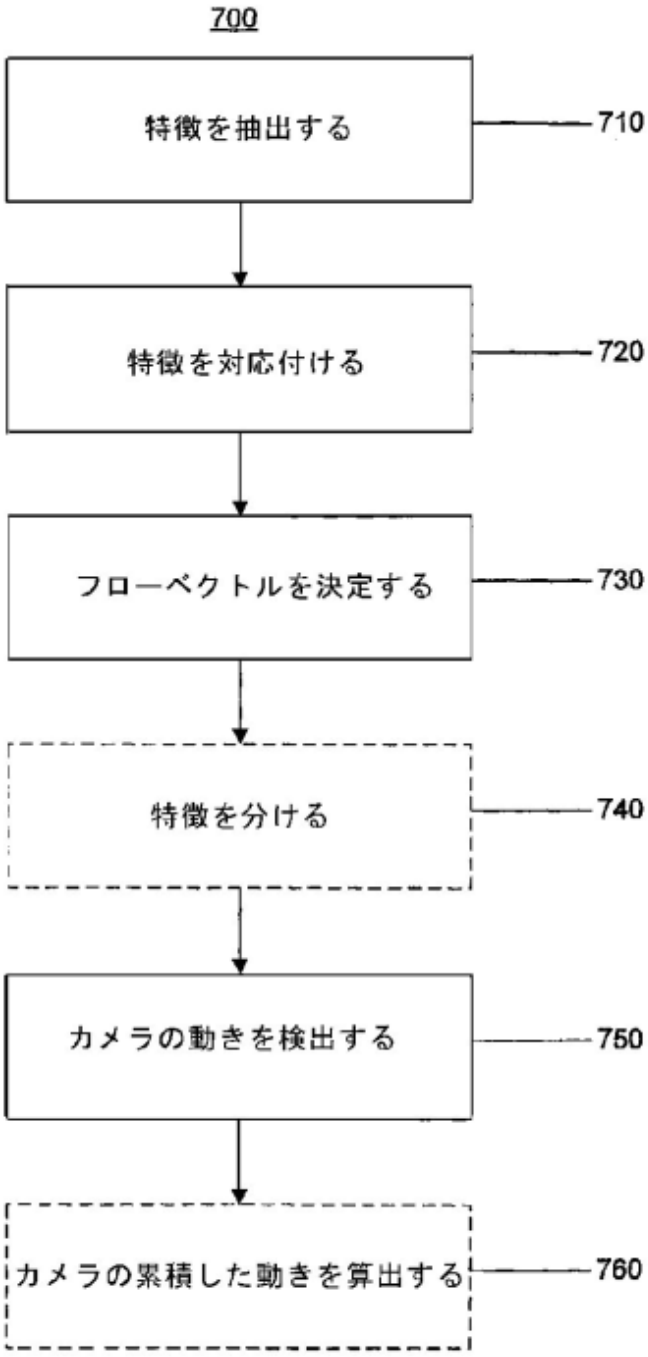

FIG. 7

特徴を抽出する Extract Features
特徴を対応付ける Match Features
フローベクトルを決定する Determine Flow Vectors
特徴を分ける Segment Features

カメラの動きを検出する Determine Motion of Camera
カメラの累積した動きを算出する Calculate Cumulative Motion of Camera

B The invention described in Cited Document 1

According to the description of A above in Cited Document 1, the following matters are recognized.

(A) In Cited Document 1, there is described a system for detecting movement of a camera-equipped cellular phone 100 using an optical flow of a series of images from a camera provided in the camera-equipped cellular phone 100 ([0019], FIG. 1).

(B) The camera-equipped cellular phone 100 has a camera 120 and a processor. The camera 120 captures a series of images over time while the camera-equipped cellular phone 100 is moving and the processor performs processing on the series of the images to detect the motion of the camera-equipped cellular phone 100, using a technique known as optical flow ([0020], [0021]).

(C) The processor of the camera-equipped cellular phone 100 performs processing 600 for detecting a motion ([0037], FIG. 6).

(D) The processing 600 includes capturing 610 of an image and the detection 620 of a motion. The capturing 610 of an image captures a series of images over a period of time, ([0038], [0039], and FIG. 6).

(E) The detection 620 of a motion is processing 700 for detecting a motion using optical flow. ([0039], [0045], and FIG. 7).

(F) The processing 700 includes extracting the features 710, associating the features 720, determining a flow vector of each feature 730, dividing the features 740, detecting the movement of the camera 750, and calculating the accumulated movement of the camera 760 ([0049], [0050], [0053], [0054], [0058], [0062], and FIG. 7).

(G) In the extracting the features 710, feature extraction processing is applied to each image captured by the camera, and the features in which at least one feature is present in each region of the image are extracted ([0046] and [0049]).

(H) In associating the features 720, the current image and the previous image are compared to associate the common features with each other ([0050]).

(I) In determining a flow vector of each feature 730, each flow vector having a magnitude and a direction is determined by calculating a displacement of a position of each feature in the current camera image relative to a position in the previous image. ([0053]).

(J) In dividing the features 740, since it may wrongly estimate the motion due to the moving feature itself, the features are divided to generate a set of flow vectors associated with a static element of an environment ([0054]).

(K) In detecting the movement of the camera 750, the movement is calculated from the apparent velocity of the feature within the view field represented by the flow vector of the static feature ([0058]).

(L) In calculating the accumulated movement of the camera 760, the accumulated movement of a series of images is calculated to detect a position relative to the initial position ([0062]).

(M) When the above matters are summarized, there is described the following invention (hereinafter, referred to as "Cited Invention") in Cited Document 1.

"A processing 600 for detecting a motion performed by a processor, in a camera-equipped cellular phone 100 which has a camera 120 that captures a series of images over time while the camera-equipped cellular phone 100 is moving and the processor that performs a processing on the series of the images to detect the motion of the camera-equipped cellular phone 100, using a technique known as optical flow, comprising:

the capturing 610 of an image; and the detection 620 of a motion,

wherein in the capturing 610 of an image, a series of images are captured over a period of time,

and the detection 620 of a motion is processing 700 for detecting a motion using optical flow,

the processing 700 including extracting the features 710, associating the features 720, determining a flow vector of each feature 730, dividing the features 740, detecting the movement of the camera 750, and calculating the accumulated movement of the camera 760,

wherein in the extracting the features 710, feature extraction processing is applied to each image captured, and the features in which at least one feature is present in each region of the image are extracted;

in associating the features 720, the current image and the previous image are compared to associate the common features with each other;

in determining a flow vector of each feature 730, a set of flow vectors having a magnitude and a direction is determined by calculating a displacement of a position of the feature in the current camera image relative to a position in the previous image;

in dividing the features 740, since it may wrongly estimate the motion due to the moving feature itself, the features are divided to generate a set of flow vectors associated with a static element of an environment;

in detecting the movement of the camera 750, the movement is calculated from the apparent velocity of the feature within the view field represented by the flow vector of the static feature; and

in calculating the accumulated movement of the camera 760, the accumulated movement of a series of images is calculated to detect a position relative to the initial position."

(2) Cited Document 2

In Cited Document 2, there is a description that an optical flow is a vector indicating how far and in what direction a point or figure in the image moves at the next moment and can be obtained by a difference between the plurality of the images picked up at different timings ([0023]).

(3) Cited Document 3

In Cited Document 3, the following matters are described. Underlines were provided by the body.

"[0009]

FIG. 1 is a high level block diagram depicting a navigation system 100 according to one embodiment of the present invention. Navigation system 100 includes a processing unit 102 coupled to a plurality of navigation sensors. Navigation system 100 can be used in various vehicles, including but not limited to automobiles, aircraft, unmanned air vehicles, space craft, lunar landers, and space probes, etc. In FIG. 1, the navigation sensors include vision sensors 104, RADAR sensors 106, LADAR sensors

112, and an inertial measurement unit 114. However, it is to be understood that embodiments of the present invention are not to be so limited.
[0010]

Vision sensor 104 can be implemented as an optical flow based vision sensor and/or an image registration (scene matching) based vision sensor. An optical flow based vision sensor estimates motion of objects in an image by tracking the motion of brightness patterns in the image. In other words, the movement of a brightness pattern (e.g. a pattern representing an object such as a building) indicates the motion of the vehicle relative to the object represented by the brightness pattern. For example, a brightness pattern moving to the left at a particular rate indicates the rate of movement of the vehicle to the right relative to the object represented by the brightness pattern. An image registration based vision sensor converts different images into one coordinate system in order to compare the location of features in the different images. The difference in location of the features in the different images indicates the motion of the vehicle."

According to the descriptions mentioned above, in Cited Document 3, it is described that an optical flow-based vision sensor is implemented as a vision sensor of a navigation sensor used in an aircraft.

(4) Cited Document 4

In Cited Document 4, there is a description that a plurality of feature points are set in the tracking area set corresponding to a moving object appearing on the image, and when tracking the moving object is performed by tracking each of the plurality of feature points from the previous frame to the next frame, the plurality of feature points are preferably distributed uniformly over the entire tracking region by selecting the distance between the two feature points to be equal to or greater than a predetermined distance ([0010] and [0036]).

(5) Cited Document 5

In Cited Document 5, there is a description that high-speed processing is possible by dividing the screen into a plurality of areas in advance and calculating the optical flow for each representative point of the plurality of regions ([0036] to [0038], [0059], and [0060]).

(6) Cited Document 6

In Cited Document 6, there is a description that the extraction and tracking of the feature points are performed to a plurality of images continuously taken, and when creating a single composite image by combining and superimposing the positions of a plurality of images using the projective transformation matrix obtained from the amount of movement, a number of the feature points to be extracted is increased or decreased according to the brightness of an environment where the image was taken ([0002], [0047] to [0049]).

2 Regarding Invention 1

(1) Comparison

In comparison of Invention 1 and Cited Invention, the. following are recognized.

A "A camera-equipped cellular phone 100" of Cited Invention corresponds to "a platform" of Invention 1.

B Since Cited Invention "calculates the accumulated movement of a series of images to detect a position relative to the initial position" in "calculating the accumulated movement of the camera 760," it can be said that "processing 600 for detecting a motion" of Cited Invention is a method of detecting a position of "a camera-equipped cellular phone 100." Therefore, "processing 600 for detecting a motion" of Cited Invention corresponds to "a method of identifying a position of a platform" of Invention 1.

C "A camera 120" of Cited Invention corresponds to "a camera system" of Invention 1. Then, since "a series of images" "captured" "over a period of time" in "the capturing 610 of an image" of Cited Invention is "a series of images" "captured" by "a camera 120" of "the camera-equipped cellular phone 100" "over time" "while the camera-equipped cellular phone 100 is moving," it corresponds to "a series of images generated by a camera system on the platform while the platform is moving" of the Invention.

D Since Cited Invention in "extracting the features 710," "applies a feature extraction processing to each image captured, and extracts the features in which at least one feature is present in each region of the image," and in "associating the features 720," "compares the current image and the previous image to associate the common features with each other," it is obvious that both of "the current image" and "the previous image" are one of "each image captured." Also, it is obvious that both are the image captured in different times.

On the other hand, since "identifying a first location of features in a first image in a series of images" of Invention 1 comprises "receiving a current image of the series of the images from the camera system," "a first image" of Invention 1 is "a current image of the series of the images." Also, since "identifying the second location of the features in the second image of the series of the images" of Invention 1 comprises "identifying a plurality of second locations in the image frame, each of the plurality of second locations corresponding to the feature in a previous image of the series of the images," "a second image taken in a different time from the first image" of Invention 1 is "a previous image of the series of the images."

According to the matters mentioned above, "a current image" and "a previous image" of Cited invention correspond to "a first image" and "a second image photographed at a different time from the first image" of Invention 1.

E Since Cited Invention "calculates a displacement of a position of each feature in the current image relative to a position in the previous image" in "determining a flow vector of each feature 730," when "applying feature extraction processing to each image captured, and extracting the features in which at least one feature is present in each region of the image" in "extracting the features 710," it is obvious that "a position of each feature" is identified. Then, "a position of each feature" of Cited invention corresponds to "locations" of "the features" of the Invention.

From the above and C and D, in "extracting the features 710" "applying a feature extraction processing to each image captured, and extracting the features in which at least one feature is present in each region of the image" of Cited Invention, the one in which "each image captured" is "a current image" corresponds to "identifying a first location of features in a first image in a series of images generated by a camera system on the platform while the platform is moving" of Invention 1.

Similarly, in "extracting the features 710" "applying a feature extraction processing to each image captured, and extracting the features in which at least one feature is present in each region of the image" of Cited Invention, the one in which "each image captured" is "a previous image" corresponds to "identifying a second location of features in a second image taken at a different time from the first image in the series of the images generated by the camera system on the platform while the platform is moving."

F In Cited Invention, "since it may wrongly estimate the motion due to a feature that moves itself, the features are divided to generate a set of flow vectors associated with a static element of an environment" in "dividing the features 740", this means eliminating

"a feature that moves itself," and thus it is obvious that it is determined whether or not "the feature" is moving, as a presupposition thereof. Therefore, Cited Invention comprises the constitution corresponding to "determining whether or not the features are moving in an environment in a view field of the camera system" of Invention 1.

G "A displacement of a position of each feature in the current image relative to a position in the previous image" in Cited Invention is nothing but a difference between "a position of each feature in the current image" and "a position of the feature in the previous image." Therefore, "calculating a displacement of a position of each feature in the current image relative to a position of the feature in the previous image" in "determining a flow vector of each feature 730" of Cited Invention, based on E above, corresponds to "identifying a difference between the first location of the features in the first image and the second location of the features in the second image" of Invention 1.

H "Determining a set of flow vectors, each of the flow vectors having a magnitude and a direction" in "determining a flow vector of each feature 730" of Cited Invention, based on G above, corresponds to "identifying shift in a perspective of the camera system from the difference between the first location of the features in the first image in the series of the images and the second location of the features in the second image in the series of the images" of Invention 1.

I "Detecting the movement of the camera 750" "calculating the movement from the apparent velocity of the feature within the view field represented by the flow vector of the static feature" of Cited Invention, based on F above, corresponds to "identifying a change in the position of the platform based on the shift in the perspective, in response to the determination that the features do not move in the environment in the view field of the camera system" of Invention 1.

J As described in F above, in "extracting the features 710", "applying a feature extraction processing to each image captured, and extracting the features in which at least one feature is present in each region of the image," the one in which "each image captured" is "a current image" corresponds to "identifying a first location of features in a first image in a series of images generated by a camera system on the platform while the platform is moving" of Invention 1.

Here, since "extracting the features 710" of Cited Invention "applies a feature extraction processing to each image captured," it is obvious that it receives "each image captured," namely "a current image" from "the camera 120."

Therefore, in "extracting the features 710", "applying feature extraction processing to each image captured, and extracting the features in which at least one feature is present in each region of the image," the one in which "each image captured" is "a current image" comprises a constitution corresponding to "receiving a current image of the series of the images from the camera system" of Invention 1.

K As described E above, in "extracting the features 710", "applying feature extraction processing to each image captured, and extracting the features in which at least one feature is present in each region of the image" of Cited Invention, it is obvious that "a position of each feature" is identified, and "a position of each feature" corresponds to "locations" of "the features" of the Invention.

Therefore, in "extracting the features 710", "applying a feature extraction processing to each image captured, and extracting the features in which at least one feature is present in each region of the image" of Cited Invention, the one in which "each image captured" is "a current image" corresponds to "identifying a plurality of first locations in an image frame of the camera system, each of the plurality of first locations corresponding to the features in the current image of the series of the image" of Invention 1.

Similarly, in "extracting the features 710", "applying feature extraction processing to each image captured, and extracting the features in which at least one feature is present in each region of the image" of Cited Invention, the one in which "each image captured" is "a previous image" corresponds to "identifying a plurality of second locations in the image frame, each of the plurality of second locations corresponding to the feature in a previous image of the series of the images."

L As described in G above, "calculating a displacement of a position of each feature in the current image relative to a position of the feature in the previous image" in "determining a flow vector of each feature 730" of Cited Invention, corresponds to "identifying a difference between the first location of the features in the first image and the second location of the features in the second image" of Invention 1.

Here, since in Cited Invention, in "extracting the features 710" before "determining a flow vector of each feature 730," "feature extraction processing is applied to each image captured, the features in which at least one feature is present in each region

of the image are extracted," it can be said that "the features are extracted" considering the positions of "the features" (namely, based on the positions of "the features").

Therefore, Cited Invention comprises a constitution corresponding to "selecting the first location from the plurality of identified first locations based on" "at least one of the positions of the features and past movement of the features" of Invention 1.

Further, since in Cited Invention, in "associating the features 720" before "determining a flow vector of each feature 730," "the current image and the previous image are compared to associate the common features with each other," "a position of each feature in the current image" and "a position of the feature in the previous image" are "a position" "in the current image" and "a position" "in the previous image" relating to the same "feature."

Therefore, in "determining a flow vector of each feature 730" of Cited Invention, "calculating a displacement of a position of each feature in the current image relative to a position in the previous image" corresponds to "identifying the difference by using the selected first location and the second location corresponding to the same feature part as a feature part in the selected first location" of Invention 1.

(2) Corresponding feature and different features

When the results of the comparison of the above (1) are summarized, the corresponding feature and the different features between Invention 1 and Cited Invention are as follows.

A Corresponding feature

"A method for identifying a position of a platform, comprising:

identifying a first location of features in a first image in a series of images generated by a camera system on the platform while the platform is moving;

identifying a second location of features in a second image taken at a different time from the first image in the series of the images generated by the camera system on the platform while the platform is moving;

determining whether or not the features are moving in an environment in a view field of the camera system;

identifying difference between the first location of the features in the first image and the second location of the features in the second image;

identifying shift in a perspective of the camera system from the difference between the first location of the features in the first image in the series of the images and the second location of the features in the second image in the series of the images; and

identifying a change in the position of the platform based on the shift in the perspective, in response to the determination that the features do not move in the environment in the view field of the camera system,

wherein identifying the first location of the features in the first image in the series of images comprises

receiving a current image of the series of the images from the camera system; and

identifying a plurality of first locations in an image frame of the camera system, each of the plurality of first locations corresponding to the features in the current image of the series of the images,

wherein identifying the second location of the features in the second image of the series of the images comprises

identifying a plurality of second locations in the image frame, each of the plurality of second locations corresponding to the feature in a previous image of the series of the images,

wherein identifying the difference comprises

selecting the first location from the plurality of identified first locations based on at least one of the positions of the features and past movement of the features; and

identifying the difference by using the selected first location and the second location corresponding to the same feature part as a feature part in the selected first location.

B The different features

(A) Different Feature 1

In Invention 1, "a platform" "is selected from an aircraft and a robotic manipulator"; that is, "a platform" is "an aircraft" or "a robotic manipulator," whereas in Cited Invention, "a platform" is "a camera-equipped cellular phone 100."

(B) Different Feature 2

In Invention 1, a selection in "selecting the first location from the plurality of identified first locations" is based not only on "at least one of the positions of the features and past movement of the features," but also on "an operation state of the platform," whereas in Cited Invention, in "extracting the features 710", when "feature extraction processing is applied to each image captured, and the features in which at least one feature is present in each region of the image are extracted," although positions of "the features" are considered, an operation state of "a camera-equipped cellular phone 100" (corresponding to "a platform" of Invention 1) is not considered.

(3) Judgment on the different features

A Regarding Different Feature 1

In Cited Document 1, there is a description that the absolute positioning function may be used in navigation applications such as tracking the position of a user in a real-world environment to navigate the user in an environment such as a store or a shopping mall ([0042]). This suggests that Cited Invention is used for navigation.

On the other hand, in Cited Document 3, as described in 1(3) above, it is described that an optical flow-based vision sensor is implemented as a vision sensor for a navigation sensor used in an aircraft. Then, it is recognized that Cited Invention uses an optical flow-based vision sensor.

Then, using Cited Invention for the navigation of an aircraft could be easily conceived of by a person skilled in the art base on the matters described in Cited Document 1 and Cited Document 3. Consequently, it is obvious that Cited Invention comprises the constitution of Invention 1 relating to Different Feature 1.

B Regarding Different Feature 2

In "extracting the feature 710" of Cited Invention, when "feature extraction processing is applied to each image captured, and the features in which at least one feature is present in each region of the image are extracted", considering an operation state of "a camera-equipped cellular phone 100" is not described and suggested in any one of Cited Document 1 to Cited Document 6.

In "extracting the feature 710" of Cited Invention, when "feature extraction processing is applied to each image captured, and the features in which at least one feature is present in each region of the image are extracted," there is no reason to consider an operation state of "a camera-equipped cellular phone 100," and thus it cannot be recognized that it is obvious to a person skilled in the art.

Therefore, it cannot be said that the constitution of Invention 1 relating to Different Feature 2 could be easily conceived by a person skilled in the art based on Cited Invention and the matters described in Cited Document 1 to Cited Document 6.

(4) Summary of Invention 1

As described above, it cannot be said that Invention 1 could be easily conceived by a person skilled in the art based on the inventions described in Cited Document 1 to Cited Document 3, or further even based on the inventions described in Cited Document 4 to Cited Document 6.

3 Regarding Invention 2 to Invention 7

Invention 2 to Invention 7 includes all constitutions of Invention 1, and thus differ from Cited Invention at least in Different Feature 1 and Different Feature 2 (2 (2) B (A) and (B) above) between Invention 1 and Cited Invention. Then, as described in 2 (3) B, since it cannot be said that the constitution of Invention 1 relating to Different Feature 2 could be easily conceived by a person skilled in the art based on Cited Invention and the matters described in Cited Document 1 to Cited Document 6, the constitutions of Invention 2 to Invention 7 relating to Different Feature 2 are the same.

Therefore, it cannot be said that Invention 2 to Invention 7 could be easily invented by a person skilled in the art based on the inventions described in Cited Document 1 to Cited Document 3 or further even based on the inventions described in Cited Document 4 to Cited Document 6.

4 Regarding Invention 8 to Invention 15

Invention 8 is the invention of an apparatus performing a method according to Invention 1, and is the invention that is different from Invention 1 in just category expression. Then, Invention 8 includes the constitution corresponding to the constitution of Invention 1 relating to Different Feature 2. Invention 9 to Invention 15, also include all the constitution of Invention 8, and hence include the constitution corresponding to the constitution of Invention 1 relating to Different Feature 2, as do Invention 8.

Then, as described in 2 (3) B above, it cannot be said that the constitution of the Invention relating to Different Feature 2 could be easily conceived by a person skilled in the art based on Cited Invention and the matters described in Cited Document 1 to Cited Document 6, and thus the constitutions of Invention 8 to Invention 15 corresponding to that are the same.

Therefore, it cannot be said that Invention 8 to Invention 15 could be easily invented by a person skilled in the art based on the inventions described in Cited Document 1 to Cited Document 3, or further even based on the inventions described in Cited Document 4 to Cited document 6.

5 Summery of Reason 3 of the examiner's decision (inventive step)

As described above, Reason 3 of the examiner's decision cannot be maintained.

No. 9 Closing

As described above, it cannot be said that the present application should be rejected due to the reasons of the examiner's decision.

In addition, no other reasons for rejecting the present application are found.

Therefore, the appeal decision shall be made as described in the conclusion.

July 1, 2019

Chief administrative judge: NAKATSUKA, Naoki

Administrative judge: KOBAYASHI, Norifumi

Administrative judge: HAMANO, Takashi