BESCHWERDEKAMMERN
DES EUROPÄISCHEN
PATENTAMTS

BOARDS OF APPEAL OF
THE EUROPEAN PATENT
OFFICE

CHAMBRES DE RECOURS
DE L'OFFICE EUROPÉEN
DES BREVETS

Internal distribution code:
(A) [-] Publication in OJ
(B) [-] To Chairmen and Members
(C) [-] To Chairmen
(D) [X] No distribution

Datasheet for the decision
of 3 June 2015

Case Number:	T 1911/10 - 3.4.01
Application Number:	07252717.9
Publication Number:	1879129
IPC:	G06K9/00, G06F3/01
Language of the proceedings:	EN

Title of invention:
Gesture recognition simultation system and method

Applicant:
Northrop Grumman Systems Corporation

Headword:

Relevant legal provisions:
EPC Art. 52(1)
EPC 1973 Art. 56

Keyword:
Inventive step - after amendment

Decisions cited:

Catchword:

Beschwerdekammern
Boards of Appeal
Chambres de recours

European Patent Office
D-80298 MUNICH
GERMANY
Tel. +49 (0) 89 2399-0
Fax +49 (0) 89 2399-4465

Case Number: **T 1911/10 - 3.4.01**

D E C I S I O N
of Technical Board of Appeal 3.4.01
of 3 June 2015

Appellant: (Applicant)	Northrop Grumman Systems Corporation 1840 Century Park East Los Angeles, CA 90067-2199 (US)
Representative:	Schmidt, Steffen J. Wuesthoff & Wuesthoff Patentanwälte PartG mbB Schweigerstrasse 2 81541 München (DE)
Decision under appeal:	Decision of the Examining Division of the European Patent Office posted on 20 April 2010 refusing European patent application No. 07252717.9 pursuant to Article 97(2) EPC.

Composition of the Board:

Chairman	G. Assi
Members:	F. Neumann
	J. Geschwind

Summary of Facts and Submissions

I.   The appeal lies from the decision of the examining
        division refusing European patent application number 07
        252 717.9.

II.   The examining division refused the application because
        claim 1 of each of the requests on file at that time
        was held to lack inventive step. The following
        documents were cited *inter alia*:

        D1:   KORIDA, K. et al.: "*An interactive 3D interface
                for a virtual ceramic art work environment*";
                Virtual Systems and Multimedia, 1997; VSSM '97
                International Conference Proceedings; pages
                227-234; XP010245649;
        D9:   SUTCLIFFE, A. et el.: "*Presence, memory and
                interaction in virtual environments*"; Int.
                Journal of Human-Computer Studies; vol. 62, pages
                307-327; 17 January 2005;
        D10:   EP-A-1 223 537;
        D11:   LEIBE, B. et al.: "*Towards Spontaneous
                Interaction with the Perceptive Workbench*";
                Virtual Reality; November/December 2000; pages
                54-65.

III.   With the statement setting out the grounds of appeal,
        the appellant requested that the decision under appeal
        be set aside and that a patent be granted on the basis
        of one of three sets of claims filed with the statement
        of grounds and forming the basis of a main request and
        first and second auxiliary requests.

        As a precautionary measure, oral proceedings were
        requested.

IV.   In a communication of the Board issued in preparation
       for an oral proceedings, objections were raised against
       the independent claims of the requests on file under
       Article 123(2) EPC and Articles 83 and 84 EPC 1973. In
       addition thereto, the question of inventive step was
       addressed for those independent claims which could be
       sufficiently understood.

       The Board referred in its communication to D9 and to

       D3:   SATO, Y. et al.: "*Real-Time Input of 3D Pose and
               Gestures of a User's Hand and Its Applications
               for HCI*"; Proceedings IEEE Virtual Reality 2001;
               Yokohama, Japan; 13 March 2001; pages 79-86.

V.   In response to the Board's communication, by letter of
       6 May 2015, the appellant filed four new sets of claims
       forming the basis of a new main request and first,
       third and fourth auxiliary requests. The second
       auxiliary request filed with the statement setting out
       the grounds of appeal was maintained.

VI.   During the oral proceedings the appellant withdrew all
       previous requests and filed a single set of claims 1 to
       7, requesting that a patent be granted on the basis of
       this single claim set.

VII.   Claim 1 reads as follows:

       "*A method of interacting with a simulated object (360,
       410), the method comprising:
       generating a three-dimensional image of the simulated
       object (360, 410) having a functional component (412),
       wherein the functional component (412) is a portion of
       the simulated object (360, 410) with which simulated
       interaction can be performed;*

illuminating a retroreflective background surface (210, 356, 406) with a first light source (206, 354, 404) and a second light source (208, 354, 404), wherein the first light source is coupled to a first camera (202, 352) and the second light source is coupled to a second camera (204, 352) and wherein light from the first light source is reflected directly back to the first camera and light from the second light source is reflected directly back to the second camera; performing an input gesture at or near a location of the functional component (412), wherein the input gesture is formed from a six-degree of freedom motion based on changes in three-dimensional location and orientation of the sensorless input object (212), the sensorless input object being a hand of a user; generating, by the first camera, a first plurality of images associated with the sensorless input object (212) based on a reflected light contrast between the sensorless input object (212) and the illuminated retroreflective background surface (210, 356, 406) caused by the first light source (206, 354, 404); generating, by the second camera, a second plurality of images associated with the sensorless input object (212) based on a reflected light contrast between the sensorless input object (212) and the illuminated retroreflective background surface (210, 356, 406) caused by the second light source (208, 354, 404); forming pairs of images, each pair of images comprising an image of the first plurality of images taken by the first camera and an image of the second plurality of images taken by the second camera at the same time; determining, for each of the pairs of images, a three-dimensional shape and a physical location of the sensorless input object at a given time based on a relative parallax separation of the respective pair of images;

determining changes in a three-dimensional shape and/or a physical location of the sensorless input object (212, 364) based on the determined three-dimensional shapes and the determined physical locations of the sensorless input object at the given times; determining the input gesture based on the determined changes in the three-dimensional shape and/or the physical location of the sensorless input object (212); accessing an object library (20) that is configured to store data associated with a plurality of simulated objects (360, 410) including three-dimensional image information, information associated with the functional component (412) of the respective simulated object (360, 410), a predefined action associated with the functional component (412), and a predefined gesture associated with the predefined action for the functional component; accessing a gesture library (22) that is configured to store a plurality of universal gestures applicable to any of the stored plurality of simulated objects (360, 410); determining if the input gesture matches one of the universal gestures stored in the gesture library (22) or the predefined gesture associated with the predefined action for the functional component (412) stored in the object library (20); and displaying a simulated action associated with the matched universal gesture or the predefined gesture on a portion of the simulated object (360, 410) associated with the functional component (412) so that an automatic rendering of the simulated action on the portion of the simulated object (360, 410) is caused."

Claims 2 to 7 are dependent claims.

Reasons for the Decision

1.   The appeal is admissible.

2.   The Board is satisfied that the current claims meet the
        requirements of Article 123(2) EPC and Article 84 EPC
        1973. The invention is also sufficiently disclosed
        (Article 83 EPC 1973).

3.   Inventive step

3.1   In the contested decision, the examining division
        presented arguments using either document D1 or D9 or
        D11 as the closest prior art for the independent claims
        of the various requests on file at that time. The
        current independent claim has been modified extensively
        compared to the independent claims on which the
        contested decision was based. The appellant considered
        that D1 represented the closest prior art for this new
        independent claim. The Board agrees with this finding.

        D1 relates to the design and implementation of an
        interactive interface to support 3D object creation in
        a virtual environment. Virtual objects are presented
        stereoscopically through LCD shutter glasses just in
        front of the user and the user can manipulate the
        virtual objects directly by using his/her own hands
        which are fitted with two-handed instrumented gloves
        and 6-degree of freedom electromagnetic (EM) sensors.
        Data sampled from the gloves enables static postures
        and temporally varied hand shapes to be recognised.
        Data sampled from EM sensors enables movement patterns
        and current hand position to be determined. The thus-
        equipped hands can be used to provide functions such as
        dynamic gesture expressions, position and size
        indication of the virtual objects and spatial

manipulations such as translations, rotations and
deformations.

3.2   Having regard to the other prior art cited in the
       contested decision, the Board notes that D9 concerns
       the use of pinch gloves to provide input commands to a
       virtual environment. In this respect the system of D9
       is further removed from the subject-matter of current
       claim 1 since the shape of the hand is not employed to
       identify control gestures: instead it is the contact
       between the forefinger and thumb of the pinch glove
       which is registered.

       D11 involves the use of shadow architecture to track
       the movement of a hand in front of a surface. Pointing
       gestures are recognised by complementing the shadow
       monitoring with a side-viewing camera enabling the
       spatial position of the hand as well as the pointing
       direction to be determined. Although D11 discloses a
       camera-based system gesture recognition system, the
       image processing is so different to that of current
       claim 1 that it does not constitute a suitable starting
       point.

3.3   Starting from the disclosure of D1, the skilled person
       is faced with the inconvenience of a cumbersome glove-
       based tracking system which may restrict the user's
       motion due to the physical connection of the sensors to
       their controllers. The technical problem to be solved
       with respect to D1 is therefore to provide an
       alternative mechanism by which hand gestures may be
       recognised which is less cumbersome to use.

3.4   This problem is solved by providing first and second
       cameras to generate a plurality of pairs of images, the
       images of each pair having been taken by the respective

first and second cameras at the same time. The cameras
are each associated with a respective first and second
light source which illuminates the user's hand against
a retroreflective background such that light is
reflected back to the respective camera. The cameras
are arranged such that the 3D shape and location of the
user's hand at a given time can be determined on the
basis of the parallax separation of the respective pair
of images. An input gesture, which is formed from a six
degree of freedom motion, is determined from changes in
the shape and location of the hand at the given times.
Once the input gesture is established, it is determined
whether the input gesture matches a "*universal gesture*"
stored in a gesture library or a "*predefined gesture*"
stored in an object library. The object library stores
data associated with a plurality of simulated objects.
This information includes 3D image information,
information associated with the functional component of
the simulated object and a predefined action associated
therewith. Moreover, the object library includes
correspondence information which enables a "*predefined
gesture*" to be mapped to a predefined action to be
performed on the functional component (e.g. unscrewing
a screw of a housing, pulling the trigger of a gun).
The gesture library stores a plurality of "*universal
gestures*" which are applicable to any of the stored
plurality of simulated objects and can be mapped to an
action which is to be performed on the entire simulated
object (e.g. rotation or translation of the entire
object). The simulated action corresponding to the
matched "*universal gesture*" or "*predefined gesture*" is
then displayed causing an automatic rendering of the
simulated action on the virtual object.

3.5   This arrangement obviates the need to use any type of
       sensor attached to the user's hand. Furthermore, the

provision of two libraries, one including information
relating to the gestures associated with the simulated
object as a whole (the "*universal gestures*") and one
including information relating to the gestures
associated with a specific functional component of the
simulated object (the "*predefined gestures*"), means
that storage space may be reduced and the speed at
which the gestures can be determined may be improved.

3.6   The use of camera-based systems to identify input
        gestures in a human-computer interface is known from
        D3. In particular D3 discloses a method for tracking a
        user's hand in three-dimensions and recognising the
        hand's gesture without the use of any invasive devices
        attached to the hand. The user's hand is observed by
        two cameras which are placed facing the centre of the
        workspace in which the user's hand is to be moved. The
        cameras are located such that the images are taken from
        different locations and the 3D position of the hand may
        be determined by triangulation. By identifying
        characteristic points in the images of the hand, the
        orientation thereof may be determined. Various static
        hand shapes, or "*gestures*", are recognised by the
        pattern recognition software and mapped to specific
        control actions which are used to manipulate a computer
        generated object.

        The Board notes that the gesture recognition performed
        in D3 is therefore more limited than the gesture
        recognition performed in D1. Since the camera-based
        system of D3 cannot provide the full functionality of
        the glove-based system of D1, it would not be obvious
        to the skilled person to replace the gloves and EM
        sensors of D1 by the camera-based system of D3.

Moreover, the gesture recognition performed by the camera-based system of D3 lacks a number of details which are now defined in claim 1 of the present application. Specifically, in claim 1 the shape and location of the hand is determined from the parallax between two images taken by different cameras at the same time. The changes in the shape and location of the hand at given times is used to identify the input gesture. Thus, gestures associated with motion of the hand can be identified, as opposed to the merely static gestures identified in D3.

Furthermore, the input gestures in D3 are used to control only "*universal*" actions. There is no suggestion in D3 that actions associated with a specific functional component of the simulated object may be simulated. Thus there is no disclosure in D3 of the step of accessing an object library which includes information associated with a functional component and a predefined action associated with that functional component.

These features are also not disclosed in any of the remaining prior art documents cited during the examination procedure.

3.7   It is therefore not obvious to modify the method of D1 in a manner which would lead to the method currently claimed. The subject-matter of claim 1 therefore involves an inventive step (Article 52(1) EPC, Article 56 EPC 1973).

Order

For these reasons it is decided that:

1.   The decision under appeal is set aside.

2.   The case is remitted to the examining division
      with the order to grant a patent on the basis of
      claims 1 to 7 filed during the oral proceedings of
      3 June 2015 and a description and figures to be
      adapted, where appropriate.

The Registrar: The Chairman:

R. Schumacher   G. Assi

Decision electronically authenticated