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**Datasheet for the decision
of 23 January 2023**

Case Number: T 0260/20 - 3.5.07

Application Number: 12195449.9

Publication Number: 2639711

IPC: G06F17/30, G06T17/10

Language of the proceedings: EN

Title of invention:

An apparatus and a method for retrieving an object

Applicant:

Kabushiki Kaisha Toshiba

Headword:

Retrieving an object/KABUSHIKI KAISHA TOSHIBA

Relevant legal provisions:

EPC Art. 84

RPBA 2020 Art. 12(4), 13(2)

Keyword:

Claims - clarity - main request and first to ninth auxiliary
request (no)

Amendment after summons - exceptional circumstances (yes)



Beschwerdekammern

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Case Number: T 0260/20 - 3.5.07

D E C I S I O N
of Technical Board of Appeal 3.5.07
of 23 January 2023

Appellant: Kabushiki Kaisha Toshiba
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Decision under appeal: **Decision of the Examining Division of the
European Patent Office posted on 13 September
2019 refusing European patent application
No. 12195449.9 pursuant to Article 97(2) EPC**

Composition of the Board:

Chair J. Geschwind
Members: P. San-Bento Furtado
C. Barel-Faucheux

Summary of Facts and Submissions

- I. The appeal lies from the decision of the examining division to refuse European patent application No. 12195449.9.
- II. The following document was cited in the decision under appeal:
D4: I. Essa et al., "Physically-based Modeling for Graphics and Vision", Directions in Geometric Computing, 31 December 1993, pages 1 to 32.
- III. The examining division decided that the independent claims of a main request and first and second auxiliary requests added subject-matter beyond the content of the application as filed and were not inventive. The claimed subject-matter corresponded to the generic technical implementation of a non-technical mathematical method. Furthermore, the features distinguishing the claimed subject-matter from the disclosure of document D4 were not inventive and had no technical effect.
- IV. With the statement of grounds of appeal, the appellant submitted amended claims according to a main request and first to fourth auxiliary requests. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the main request or one of the four auxiliary requests.
- V. In a communication accompanying a summons to oral proceedings, the board expressed its preliminary opinion that none of the requests fulfilled the requirements of sufficiency of disclosure, clarity and inventive step, and that the main request added

subject-matter beyond the content of the application as filed.

- VI. With a letter of reply, the appellant maintained the main request and first auxiliary request; renumbered the previous second to fourth auxiliary requests as the fourth to sixth auxiliary requests and filed new claims according to a second, third and seventh to ninth auxiliary requests.
- VII. Oral proceedings were held as scheduled. At the end of the oral proceedings, the Chair announced the board's decision.
- VIII. The appellant's final requests were that the contested decision be set aside and that a patent be granted on the basis of the main request or one of the first to ninth auxiliary requests.
- IX. Claim 1 of the main request reads as follows (itemisation added by the board):
- (a) "An apparatus for use in positioning components in a computer aided design, CAD, by deciding intersection between an (N-1)-dimensional surface and an N-dimensional cuboid in an N-dimensional space, N being an integral number larger than or equal to three, characterized by:
 - (b) a query acceptance unit (105) configured to accept a retrieval query indicating the (N-1)-dimensional surface in the N-dimensional space; and
 - (c) a collision decision unit (107) configured to decide whether the (N-1)-dimensional surface intersects the N-dimensional cuboid positioned in the N-dimensional space;

- (d) wherein the collision decision unit (107) has a plurality of decision functions including zero-th ~ N-th decision functions, and decides by using the plurality of decision functions,
- (e) the zero-th ~ (N-1)-th decision functions are used for deciding whether at least a part of at least one of X-dimensional face of the N-dimensional cuboid is included in the (N-1)-dimensional surface, X being all integral numbers larger than or equal to zero, and smaller than or equal to (N-1), and
- (f) the N-th decision function is used for deciding whether the (N-1)-dimensional surface is included in the N-dimensional cuboid,
- (g) wherein the collision decision unit (107) is further configured to output an identification of the N-dimensional cuboid in a case where at least a part of at least one of X-dimensional face of the N-dimensional cuboid is included in the (N-1)-dimensional surface or the (N-1)-dimensional surface is included in the N-dimensional cuboid; and
- (h) the N-dimensional cuboid is a minimum bounded box of a component positioned in the N-dimensional space, the component and the (N-1)-dimensional surface being respective components in the CAD."

X. Claim 1 of the first auxiliary request differs from claim 1 of the main request in that, apart from editorial changes, the following amendments have been made

- the text "N being ... larger than or equal to three" in (a) has been deleted;
- the text "(N-1)-dimensional" and "N-dimensional" has been replaced with "two-dimensional" and "three-dimensional";

- the text "(N-1)-th decision functions" and "N-th decision function(s)" has been replaced with "2nd decision functions" and "3rd decision function(s)"; and
- in (e) the text "at least one of X-dimensional face" has been replaced with "a two-dimensional face" and the text "X being all ... smaller than or equal to (N-1)" has been deleted.

XI. Claim 1 of the second auxiliary request reads as follows:

"An apparatus for deciding a collision between a two-dimensional surface and a three-dimensional cuboid in a three-dimensional space, the three-dimensional cuboid being a minimum bounded box of a component positioned in the three-dimensional space, the component and the two-dimensional surface being respective components in a computer aided design, CAD, characterized by:

a query acceptance unit (105) configured to accept a retrieval query indicating the two-dimensional surface in the three-dimensional space; and

a collision decision unit (107) configured to decide whether the two-dimensional surface intersects or is included in the three-dimensional cuboid positioned in the three-dimensional space;

wherein the collision decision unit (107) has a plurality of decision functions including zero-th ~ third decision functions, and decides by using the plurality of decision functions,

the zero-th ~ second decision functions are used for deciding whether at least one of a peak, edge or face of the three-dimensional cuboid intersects the two-dimensional surface,

the third decision function is used for deciding whether the two-dimensional surface is included in the three-dimensional cuboid;

wherein the collision decision unit (107) is further configured to output an identification of the three-dimensional cuboid in a case where at least one of a peak, edge or face of the three-dimensional cuboid intersects the two-dimensional surface or the two-dimensional surface is included in the three-dimensional cuboid; and

the collision decision unit (107) executes the plurality of decision functions from the zero-th decision function in order of smaller number, and, when decision of intersection is acquired at one of the plurality of decision functions, omits execution of the plurality of decision functions having numbers larger than the one."

XII. Claim 1 of the third auxiliary request differs from claim 1 of the second auxiliary request in that, apart from editorial changes, the following text has been added at the end of the claim:

"wherein the apparatus further comprises a vector product previous calculation unit (103) configured to calculate a vector product of each peak of the three-dimensional cuboid and a vector product cache unit (104) configured to store the vector product outputted by the vector product previous calculation unit (103), and wherein the collision decision unit (107) is configured to refer to the vector products stored in the vector product cache storage unit (104) for use in deciding whether the two-dimensional surface intersects or is included in the three-dimensional cuboid positioned in the three-dimensional space."

XIII. Claim 1 of the fourth auxiliary request differs from claim 1 of the first auxiliary request in that:

- the text "An apparatus for use in positioning components in a computer aided design, CAD," has been replaced with:
"An apparatus for use in positioning photovoltaic power generation devices";
- in the text "a collision decision unit (107) configured to decide whether the two-dimensional surface intersects the three-dimensional cuboid positioned in the three-dimensional space;" the text "three-dimensional cuboid" has been replaced with "N-dimensional cuboid";
- the text "the three-dimensional cuboid is a minimum bounded box of a component positioned ... being respective components in the CAD." at the end of the claim has been replaced with:
"the three-dimensional cuboid is a minimum bounded box of an object positioned in the three-dimensional space, the object representing a photovoltaic power generation device; and
the two-dimensional surface represents an area by a shadow or a reflected light of a predetermined object, a view from a viewpoint or a circle having a radius of n km from an indicated point."

XIV. Claim 1 of the fifth auxiliary request differs from claim 1 of the fourth auxiliary request in that the text ", the object representing a photovoltaic power generation device;" (see preceding point XIII.) has been replaced with the text:

"among a plurality of objects positioned in the three-dimensional space and controlled by a database, each of the objects representing a photovoltaic power generation device;".

XV. Claim 1 of the sixth auxiliary request differs from claim 1 of the fifth auxiliary request in that, apart

from an editorial change, the following text has been added at the end of the claim:

"the collision decision unit (107) is further configured to decide whether the two-dimensional surface intersects each of a plurality of three-dimensional cuboids in parallel, each of the plurality of three-dimensional cuboids being a minimum bounded box of an object among the plurality of objects positioned in the three-dimensional space."

XVI. Claim 1 of the seventh auxiliary request differs from claim 1 of the second auxiliary request in that the text "a component positioned in the three-dimensional space, the component and the two-dimensional surface being respective components in a computer aided design, CAD" has been replaced with:

"an object positioned in the three-dimensional space representing a photovoltaic power generation device, the two-dimensional surface representing an area by a shadow or a reflected light of a predetermined object, a view from a viewpoint or a circle having a radius of n km from an indicated point".

XVII. Claim 1 of the eighth auxiliary request differs from claim 1 of the seventh auxiliary request in that the text "among a plurality of objects positioned in the three-dimensional space and controlled by a database, each of the objects" has been added before the text "representing a photovoltaic power generation device".

XVIII. Claim 1 of the ninth auxiliary request differs from claim 1 of the eighth auxiliary request in that, apart from editorial changes, the following text has been added at the end of the claim:

"the collision decision unit (107) is further configured to decide whether the two-dimensional surface intersects each of a plurality of three-dimensional cuboids in parallel, each of the plurality of three-dimensional cuboids being a minimum bounded box of an object among the plurality of objects positioned in the three-dimensional space."

XIX. The appellant's arguments, where relevant to this decision, are addressed in detail below.

Reasons for the Decision

Application

1. The application concerns an apparatus and method for determining the three-dimensional objects in a three-dimensional space which intersect ("collide" with) a two-dimensional surface (e.g. a quadric surface such as a cone, a column or a sphere) (see paragraph [0027] of the original application). This can be used, for example, to decide how to position a photovoltaic power generation device (panel) with respect to a building depending on the area of the building's shadow, where the area of the shadow corresponds to the surface (paragraphs [0006], [0028] and [0029]).
- 1.1 In order to determine whether the surface intersects a three-dimensional object, the invention determines first whether the surface intersects the three-dimensional minimum bounding box (MBB) of the object ("three-dimensional cuboid") (paragraphs [0027], [0039] and [0049] and original claim 1).

- 1.2 The apparatus according to one embodiment includes a query acceptance unit, which accepts as input a two-dimensional surface, and a collision decision unit, which determines whether the surface intersects a three-dimensional MBB (cuboid) (paragraph [0008] and original claim 1).
- 1.3 The collision detection unit uses decision functions for tests C0 to C3 ("zero-th to 3rd decision functions"). The surface is found to intersect the MBB if any of these tests C0 to C3 has a positive result (paragraphs [0049] to [0052] and original claim 1):
- (C0) The zero-th decision function determines whether any of the 8 vertices (zero-dimensional points) of the MBB is "included" in the surface.
 - (C1) The 1st decision function determines whether any part of any of the 12 edges (one-dimensional lines) of the MBB is "included" in the surface.
 - (C2) The 2nd decision function determines whether any part of any of the six faces (two-dimensional rectangles) of the MBB is "included" in the surface.
 - (C3) The 3rd decision function determines whether the surface is inside the MBB.

Admittance - all requests

2. Exercising its discretion under Article 12(4) RPBA 2020, the board decided to admit the requests submitted with the grounds of appeal, i.e. the main request, and the first and fourth to sixth auxiliary requests because they did not introduce major amendments and were directed to overcoming the grounds for refusal.
3. In reply to the board's communication, the appellant submitted the second, third and seventh to ninth auxiliary requests and argued that these requests were

admissible because in its preliminary opinion the board had raised new objections under Articles 83 and 84 EPC which had not been raised before. Furthermore, the board's inventive-step objection in its preliminary opinion had been based on a technicality assessment following decision G 1/19 of the Enlarged Board of Appeal. This decision had been taken after the grounds of appeal had been submitted in the current case and had caused substantial changes to the Guidelines for Examination in the EPO. The requests attempted to better respond to the new case law.

4. The board confirms these circumstances of the current case as described by the appellant and considers these to be exceptional circumstances under Article 13(2) RPBA 2020 justifying the admittance of the new requests submitted by the appellant in reply to the board's preliminary opinion. In view of this, the board decided to admit these new requests, i.e. the second, third and seventh to ninth auxiliary requests, into the appeal proceedings.

Main request

5. *Clarity - claim 1*

- 5.1 Claim 1 specifies in feature (c) that the collision decision unit decides whether the (N-1)-dimensional surface intersects the N-dimensional cuboid. However, in the examples described in the application in which the two-dimensional surface is a sphere (i.e. a spherical surface) with centre (x_0, y_0, z_0) and radius r , with the equation
$$(x-x_0)^2 + (y-y_0)^2 + (z-z_0)^2 - r^2 = 0,$$
the 0-decision function determines whether the vertices (x, y, z) of the three-dimensional MBB satisfy the equation

$$(x-x_0)^2 + (y-y_0)^2 + (z-z_0)^2 - r^2 \leq 0. \quad (I)$$

This is the case with embodiment A described in paragraphs [0061] to [0088] with reference to Figures 6 and 7. This embodiment illustrates the collision determination between a unit cube with diagonally opposing vertices (0,0,0) and (1,1,1) and a sphere with centre (1,0,1) and radius 1/4 (see paragraph [0061] and Figure 7). The equation used is shown in paragraph [0062], which corresponds to equation (I) for the particular sphere with centre (1,0,1) and radius 1/4:

$$0 \geq z^2 - 2*z + y^2 + x^2 - 2 * x + 31/16.$$

The vertex (1,0,1) of the MBB was found to "intersect" the sphere having centre (1,0,1) and radius 1/4 (paragraph [0082] and Figures 6 and 7).

- 5.2 If the result of equation (I) is positive, claim 1 specifies that the sphere (i.e. a spherical surface as two-dimensional surface) is considered to intersect the MBB. This means that if the MBB is inside the sphere (all vertices satisfy the equation), the collision detection unit will determine that there is an intersection, even though the spherical surface itself does not intersect the MBB. Therefore, the test is not whether the sphere (two-dimensional surface) intersects the MBB but whether the three-dimensional volume formed by the sphere intersects the three-dimensional MBB.
- 5.3 The term "included" in the phrase "whether at least a part of at least one of the X-dimensional face of the N-dimensional cuboid is included in the (N-1)-dimensional surface" of features (e) and (g) is unclear. Since a straight line cannot be part of a curved surface, it is not clear what it means to decide whether at least part of an edge (one-dimensional

straight line) is "included" in a two-dimensional spherical surface. In the examples of the description in which the (N-1)-dimensional surface is a sphere, the term "included" could be interpreted as meaning "enclosed by" or similar, but the claim is not restricted to closed (N-1)-surfaces or quadric surfaces.

- 5.4 The appellant argued that the skilled person reading the claims would understand the claimed subject-matter. The application as a whole was clear. The embodiment of paragraphs [0061] to [0088] was only an example. With regard to the example above, the appellant clarified that a point was not considered on the surface if it was inside the surface and that a part of an edge could be a single point.
- 5.5 The board does not find the appellant's arguments convincing. For the reasons given above, the expression "is included in" in features (e) and (g) is unclear. Even assuming that the skilled reader would consider that a point is "part of the X-dimensional face" or "part of the edge", the expression "part of the X-dimensional face of the cuboid is included in the (N-1)-dimensional surface" is not a clear and precise manner of expressing that "the X-dimensional face of the cuboid intersects the (N-1)-dimensional surface". Furthermore, interpreting "is included in" as "intersects" is at odds with the embodiments described in the application in which the surface is a sphere, as explained under points 5.1 and 5.2 above.
- 5.6 Therefore, claim 1 of the main request does not satisfy the requirements of Article 84 EPC.

First auxiliary request

6. *Clarity - claim 1*

6.1 The features of claim 1 of the first auxiliary request corresponding to features (c), (e) and (g) of claim 1 of the main request read as follows:

(c1) a collision decision unit (107) configured to decide whether the two-dimensional surface intersects the three-dimensional cuboid positioned in the three-dimensional space;

(e1) the zero-th ~ 2nd decision functions are used for deciding whether at least a part of a two-dimensional face of the three-dimensional cuboid is included in the two-dimensional surface, and

(g1) wherein the collision decision unit (107) is further configured to output an identification of the three-dimensional cuboid in a case where at least a part of a two-dimensional face of the three-dimensional cuboid is included in the two-dimensional surface or the two-dimensional surface is included in the three-dimensional cuboid; and

6.2 Features (c1), (e1) and (g1) use essentially the same wording as the corresponding features of claim 1 of the main request, except that "N-dimensional" and "(N-1)-dimensional" have been replaced with "three-dimensional" and "two-dimensional", and in feature (e), "X-dimensional" has been replaced with "two-dimensional". Therefore, the reasoning given above in the clarity assessment of claim 1 of the main request equally applies to claim 1 of the first auxiliary request.

6.3 It follows that the first auxiliary request does not satisfy the requirements of Article 84 EPC either.

Second auxiliary request

7. *Clarity - claim 1*

7.1 Claim 1 of the second auxiliary request adds the following feature:

(h2) the collision decision unit (107) executes the plurality of decision functions from the zero-th decision function in order of smaller number, and, when decision of intersection is acquired at one of the plurality of decision functions, omits execution of the plurality of decision functions having numbers larger than the one.

7.2 The appellant argued that amended claim 1 of the second auxiliary request was consistent with the disclosure of the description, which described in, for example, paragraphs [0049] to [0052], [0057] and [0159] that the four tests C0 to C3 were performed starting from test C0 to decide whether there was an intersection between at least one of a peak, edge or face of the cuboid and the two-dimensional surface or the two-dimensional surfaces included within the three-dimensional cuboid. When collision was detected, the other functions were not executed. This feature made clear what the appellant considered implicit in previous claims.

7.3 However, the expressions "in order of smaller number", "when decision of intersection is acquired at one of the plurality of decision functions" and "omits execution of ... decision functions having numbers larger than the one" are unclear. In particular, it is not clear what "in order of smaller number" means. The test described as "when decision of intersection is acquired" does not have a precise meaning. Besides, even assuming that "the one" refers to "one of the plurality of decision functions", it is unclear which

technical features are implied by the expressions "omits execution" and "decision functions having numbers larger than the one". The question of whether the meaning of claim 1 could be derived from the description is not relevant since claims must be clear in themselves when read by the person skilled in the art without any reference to the content of the description.

- 7.4 Therefore, claim 1 is unclear, and the second auxiliary request does not satisfy the requirements of Article 84 EPC.

Third auxiliary request

8. *Clarity - claim 1*

- 8.1 Feature (h2) is also specified in claim 1 of the third auxiliary request.

- 8.2 Therefore, for the same reasons as given for the second auxiliary request, the third auxiliary request does not satisfy the requirements of Article 84 EPC either.

Fourth to sixth auxiliary requests

9. *Clarity - claim 1*

- 9.1 Claim 1 of each of the fourth to sixth auxiliary requests also includes features (c1), (e1) and (g1) of the first auxiliary request, except that the text "three-dimensional cuboid" in (c1) has been replaced with "N-dimensional cuboid" in the corresponding feature of the fourth to sixth auxiliary requests. Therefore, for the same reasons as given above for the clarity assessment of claim 1 of the main request and the first auxiliary request, the fourth to sixth

auxiliary requests do not satisfy the requirements of Article 84 EPC either.

Seventh to ninth auxiliary requests

10. *Clarity - claim 1*

10.1 Claim 1 of each of the seventh to ninth auxiliary requests also specifies feature (h2).

10.2 Therefore, for the same reasons as given for the second auxiliary request, the seventh to ninth auxiliary requests do not satisfy the requirements of Article 84 EPC either.

Concluding remarks

11. Since none of the requests is allowable, the appeal is to be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chair:



S. Lichtenvort

J. Geschwind

Decision electronically authenticated