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Datasheet for the decision of 8 January 2024

Case Number: T 2025/21 - 3.4.02

Application Number: 12861719.8

Publication Number: 2756350

IPC: G02B27/02, G02B26/02, G02B26/08

Language of the proceedings: EN

Title of invention:
OPTICAL DISPLAY SYSTEM AND METHOD WITH VIRTUAL IMAGE CONTRAST CONTROL

Applicant:
Google LLC

Relevant legal provisions:
EPC Art. 83, 84, 111(1)
RPBA 2020 Art. 11, 12(8)

Keyword:
Decision in written proceedings
Clarity of claims and sufficiency of disclosure (main request: yes)
Remittal for further prosecution (yes)

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Beschwerdekammern

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Case Number: T 2025/21 - 3.4.02

D E C I S I O N
of Technical Board of Appeal 3.4.02
of 8 January 2024

Appellant: (Applicant)	Google LLC 1600 Amphitheatre Parkway Mountain View, CA 94043 (US)
Representative:	Maikowski & Ninnemann Patentanwälte Partnerschaft mbB Kurfürstendamm 54-55 10707 Berlin (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 2 July 2021 refusing European patent application No. 12861719.8 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	R. Bekkering
Members:	F. J. Narganes-Quijano
	T. Karamanli

Summary of Facts and Submissions

I. The appellant (applicant) lodged an appeal against the decision of the examining division refusing European patent application No. 12861719.8.

In its decision, the examining division held in respect of the main request and the first and second auxiliary requests then on file that the claims did not meet the requirement of clarity of Article 84 EPC, and that the claimed invention was not sufficiently disclosed within the meaning of Article 83 EPC.

II. With the statement setting out the grounds of appeal, the appellant submitted claims according to a main request and auxiliary requests 1 and 2 identical to the claims of the main request and the first and second auxiliary requests underlying the decision under appeal, respectively, and claims according to a new auxiliary request 1a. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the claims of the main request or of one of auxiliary requests 1, 1a and 2, all requests filed with the statement of grounds of appeal.

The appellant also requested oral proceedings as an auxiliary measure.

III. In a communication under Rule 100(2) EPC, the board expressed its preliminary opinion that the claims of the main request met the requirement of clarity of Article 84 EPC and that the invention defined in the claims of the main request was sufficiently disclosed within the meaning of Article 83 EPC. The appellant was

also informed that the board was minded to issue a decision in written procedure setting aside the decision under appeal and remitting the case to the examining division for further prosecution.

IV. In reply to the board's communication, the appellant, by letter dated 29 September 2023, expressed its agreement with the remittal of the case to the examining division without holding oral proceedings.

V. Independent claims 1 and 6 of the main request - with the feature labelling "a" to "g" in square brackets used during the proceedings being inserted in independent claim 6 by the board - read as follows:

" 1. A method comprising:

generating a light pattern using a display panel;

forming a virtual image from the light pattern utilizing one or more optical components, wherein the virtual image is viewable from a viewing location;

receiving, by an optical sensor, external light from a real-world environment incident on the optical sensor, wherein the real-world environment is viewable from the viewing location;

obtaining an image of the real-world environment from the received external light;

identifying a background feature in the image of the real-world environment over which the virtual image is overlaid;

extracting, from the image of the real-world environment, pixel data corresponding to the background feature, the pixel data being indicative of one or more visual characteristics of the background feature, wherein the pixel data relate to an intensity of the background features;

comparing the pixel data indicative of the one or more visual characteristics to an upper threshold value and a lower threshold value;

converting the extracted pixel data into an image data mask M associated with real values between and including 0 and 1;

controlling the generation of the light pattern based on the comparison, comprising increasing the contrast between the virtual image and the background feature if the pixel data is higher than the upper threshold or lower than the lower threshold, wherein increasing the contrast between the virtual image and the background feature includes enhancing the virtual image to obtain an enhanced virtual image using histogram equalization and blending the virtual image with the enhanced virtual image using the image data mask M as a blending factor, wherein a blended image having an intensity I_corrected is obtained according to

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I_corrected(x,y) = M(x,y) * I_original(x,y) +
    (1 - M(x,y)) * I_enhanced(x,y),
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wherein I_enhanced(x,y) is the intensity of a pixel of the enhanced virtual image located at (x,y) and I_original(x,y) is the intensity of a pixel located at (x,y) in the virtual image."

" 6. [*a*] A display system comprising:

[*b*] a display panel configured to generate a light pattern;

[*c*] one or more optical components coupled to the display panel and configured to transmit the light pattern and external light from a real-world environment, wherein the light pattern is viewable from a viewing location through the one or more optical

components as a virtual image superimposed over the real-world environment;

[*d*] an optical sensor coupled to the one or more optical components and configured to receive the external light to obtain an image of the real-world environment; and

[*e*] a processor coupled to the display panel and the optical sensor and configured to identify a background portion of the image of the real-world environment over which the virtual image is superimposed, to extract pixel data corresponding to the background portion and being indicative of one or more visual characteristics of the background portion, wherein the pixel data relate to an intensity of the background features, to convert the extracted pixel data into an image data mask M associated with real values between and including 0 and 1,

[*f*] to compare the pixel data to an upper threshold value and a lower threshold value, and to control the generation of the light pattern, based on the comparison, to increase the contrast between the virtual image and the background portion if the pixel data is higher than the upper threshold or lower than the lower threshold,

[*g*] wherein increasing the contrast between the virtual image and the background portion includes enhancing the virtual image using histogram equalization to obtain an enhanced virtual image and blending the virtual image I_original with the enhanced virtual image I_enhanced using the image data mask M as a blending factor to provide a blended image I_corrected according to

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I_corrected(x,y) = M(x,y) * I_original(x,y) +
    (1 - M(x,y)) * I_enhanced(x,y),
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wherein (x, y) designates a pixel location."

Reasons for the Decision

1. The appeal is admissible.

2. *Procedural matters*

In reply to the board's communication under Rule 100(2) EPC informing the appellant of the board's preliminary opinion that the claims of the main request met the requirement of Articles 83 and 84 EPC and that, in view of this preliminary assessment, the board was minded to issue a decision in written procedure setting aside the decision under appeal and remitting the case to the examining division for further prosecution (*cf.* point III above), the appellant, by letter dated 29 September 2023, expressed its agreement with the remittal of the case to the examination division without holding oral proceedings (*cf.* point IV above).

The present decision is in conformity with the preliminary opinion expressed by the board in the aforementioned communication. Consequently, in view of the appellant's agreement with the remittal of the case to the examination division without holding oral proceedings, the board considers that oral proceedings under Article 116(1) EPC would serve no purpose and that, therefore, no oral proceedings are necessary or expedient in the case at hand. Therefore, the present decision is taken in written proceedings in accordance with Article 12(8) RPBA 2020, with due regard for the appellant's procedural rights under Articles 113 and

116 EPC. In particular, the principle of the right to be heard under Article 113(1) EPC is fully respected, since the appellant has presented arguments on the merits and the board has based its decision on those arguments. The case is ready for decision on the basis of the contested decision to be reviewed and the appellant's written submissions.

3. *Main request - Articles 83 and 84 EPC*

The examining division held in its decision that independent claim 6 was not clear (Article 84 EPC) and that the invention defined in this claim was not sufficiently disclosed (Article 83 EPC). In addition, the examining division also held that the same objections applied to claim 1.

3.1 According to a first objection raised by the examining division, the expression "background portion" referred to in independent claim 6 was unclear and it was also unclear how the processor was configured to identify the background portion (feature [e] of independent claim 6). In addition, there was no specification in the claim and in the whole application whether the image of the real-world environment obtained by the optical sensor (feature [d]) and the virtual image had the same size or not. It was to be expected that the size of the image of the real-world environment was larger than the size of the virtual image which depended on the display panel and, consequently, the virtual image could be overlaid anywhere within the image of the real-world environment. It was also not clear how the processor was configured to determine the position where the virtual image was overlaid on the image of the real-world environment in order to extract

pixels of the image of the real-world environment corresponding to the overlapping region.

3.1.1 The board first notes that the "background portion" is defined in independent claim 6 as "a background portion of the image of the real-world environment over which the virtual image is superimposed" (feature [e] of the claim). In the board's view, this definition clearly defines the background portion, and, in addition, it corresponds to the interpretation of the expression "background portion" indicated by the examining division in its decision, i.e. as the portion of the image of the real-world environment that overlaps with the virtual image. Furthermore, it follows from this definition of the background portion that the size of the virtual image cannot be bigger than the real-world environment, and in particular not bigger than the real-world environment as seen by the user through the display system (features [c] to [e]).

3.1.2 Moreover, the virtual image may, as noted by the examining division in its decision, adopt different positions with respect to the real-world environment viewable through the optical system, and the examining division objected that independent claim 6 did not specify how the processor could be configured to determine the mentioned position and therefore to identify the claimed background portion.

The board, however, is not convinced by this objection. According to independent claim 6 the processor is not merely "coupled to the display panel", but also "configured [...] to control the generation of the light pattern" by the display panel (features [e] and [f]) and to correct the intensity of the image pixels of the virtual image (feature [g]) and therefore the

intensity of the pixels of the light pattern generated by the display panel. The skilled person would therefore understand that the processor contains information on the light pattern to be generated by the display panel and that it is arranged to control the intensity of the pixels of the light pattern. In addition, the processor is "coupled [...] to the optical sensor" (feature [e]), and the optical sensor is in turn "coupled to the one or more optical components" and configured to obtain an image of the real-world environment (feature [d]). Therefore, the processor also contains information on the image of the real-world environment viewed by the user through the display system. It follows that the processor contains sufficient information enabling the identification of the background portion of the image of the rear-world environment over which the virtual image is superimposed.

To the extent that the aforementioned objection was raised by the examining division as an objection of clarity under Article 84 EPC, the board first notes that the invention defined in independent claim 6 is directed to the imaging characteristics of the claimed optical system, and in particular to the problem relating to the contrast between the superimposed images viewed by the user (features [e] to [g]), and not to the features of the optical system relating to the structural arrangement of the different components of the optical system determining the spatial position of the virtual image with respect to the real-world environment viewable through the system. In addition, the person skilled in the technical field under consideration would, on the basis of the common general knowledge in this technical field, understand that the processor is configured to determine, on the basis of

the information mentioned above and of the structural and optical arrangement of the different components of the optical system, the relative position of the virtual image viewable by the user through the display system and of the image of the real-world environment as viewed by the user through the optical system, and to subsequently extract pixels of the image of the real-world environment corresponding to the background portion defined in the claim. Therefore, the board takes the view that independent claim 6 is clear in this respect (Article 84 EPC).

Furthermore, to the extent that the examining division's objection relates to the requirement of Article 83 EPC, the board notes that, in addition of the common general knowledge referred to in the preceding paragraph, the description of the application discloses examples of the structural and optical arrangement of the optical components of the display system (Fig. 2 and 5 to 7, together with the corresponding description), of the processor controlling the display panel and therefore the content of the virtual image (paragraphs [0019], [0066] and [0068]), of the determination of the position of the virtual image with respect to the real-world environment (paragraph [0039]), of the alignment of the virtual image and of the calibration of its position with respect to the image of the real-world environment viewed by the user through the optical system (paragraphs [0047] and [0050]), of the correction of possible misalignments between the two images (paragraph [0052]), and of the identification of the features of the background portion mentioned in feature [e] (paragraphs [0048] and [0053]). In the board's view, it would be a matter of routine practice for the person skilled in the technical field under

consideration to program the processor (i.e. to determine the "data and instructions" mentioned in paragraph [0024] required to carry out the processing of images mentioned in paragraph [0039], last sentence) to identify the background portion of the external image over which the virtual image is superimposed - for instance, as submitted by the appellant, by establishing a mapping between the pixel coordinates of the display panel and those of the image captured by the optical sensor - for the subsequent operation defined in feature [e] of extracting pixel data of the image corresponding to the background portion (Article 83 EPC).

3.2 According to a further objection raised by the examining division, it was not clear what the "virtual image" mentioned in independent claim 6 was. In particular, the virtual image could be interpreted to be an image projected from the display panel and could have the size, known by the processor, of the display panel. In this case, assuming that the virtual image corresponded to the full size of the display panel and that the virtual image was overlaid on a specific region of the image of the real-world environment, the overlaid portion could be determined. However, there was no information in the application in support of this reasoning.

The board notes that according to independent claim 6 the light pattern generated by the display panel is transmitted by the one or more optical components so that it "is viewable [...] through the one or more optical components as a virtual image" and that the skilled person would understand that the size of the virtual image as viewed by the user is not only determined by the size of the display panel, but also

by the optical characteristics (optical power, etc.) of the optical component(s) which - as submitted by the appellant - are known for a predetermined display system. In addition, independent claim 6 requires that the processor is configured to identify the claimed background portion, and the skilled person would understand that this identification implicitly requires that the processor contains information not only on the position of the virtual image (see point 3.1.2 above), but also on the size of the virtual image relative to the real-world environment viewed by the user through the optical system. Therefore, in view of these considerations and those already set forth in point 3.1.2 above, the board sees no deficiency in this respect, neither under the requirement of clarity of Article 84 EPC nor under the requirement of sufficiency of disclosure of Article 83 EPC.

3.3 The examining division also objected that the virtual image mentioned in independent claim 6 could be interpreted as referring only to a region or regions of the image formed by the light pattern displaying objects or information (text, drawings, etc.), the remaining region(s) being associated with pixels of the display panel that did not generate light and viewable by the user as a transparent image not considered to be part of the virtual image. In this case, the light pattern forming the virtual image could originate from any region of the display panel, and not necessarily from all pixels of the display panel, and it was not clear how the processor was configured to determine the position where the virtual image was generated from the display panel in order to determine the position where the virtual image was superimposed on the image of the real world.

The board first notes that the virtual image is defined in independent claim 6 as the virtual image of the light pattern generated by the display panel (feature [b]) and viewable through the one or more optical components (feature [c]). Therefore, in the case considered by the examining division and in which the display panel is constituted by pixels which do not project light when not activated, the skilled person would understand that the "light pattern" generated by the display panel is - as submitted by the appellant - the light pattern formed by the activated pixels of the display panel. In addition, as already concluded in point 3.1.2 above, independent claim 6 requires that the processor contains information on the light pattern generated by the display panel and also on the position of the virtual image with respect to the background portion. Therefore, following considerations analogous to those set forth in point 3.1.2 above, the processor contains sufficient information for determining the position of each of the pixels of the virtual image with respect to the background portion - independently of whether the light pattern being generated by the display panel covers the whole display panel or only a part of it and, therefore, independently of whether some of the pixels of the display panel are not activated and are viewable by the user through the optical component(s) as mentioned by the examining division, i.e. as "transparent" pixels.

3.4 In an *obiter dictum* of the decision, the examining division also expressed the view that independent claim 6 involved increasing the contrast between the virtual image and the background portion by enhancing the virtual image using histogram equalisation to obtain an enhanced virtual image and blending the original virtual image with the enhanced virtual image

as defined in feature [g]. However, the virtual image was the result of a light projection through the one or more components, and, in addition, it was not clear how the original virtual image, which is the output of a light pattern, was enhanced.

The board notes that the intensity of the virtual image viewable by the user and the image pattern generated by the display panel do not necessarily have the same intensity, but that they are directly correlated to each other as a function of the optical characteristics of the display system and in particular of the one or more optical components of the system (optical power, transmissivity and/or reflectivity, etc.). Furthermore, according to independent claim 6 the processor is "configured [...] to control the generation of the light pattern" (features [e] and [f]) and therefore to control the intensity of the pixels of the virtual image (features [f] and [g]). In addition, the use of histogram equalisation techniques for enhancing an image pertains to the common general knowledge in the technical field under consideration. Therefore, none of these considerations prejudice in the board's view the clarity of independent claim 6 (Article 84 EPC) or the sufficiency of disclosure of the invention defined in this claim (Article 83 EPC).

3.5 According to the examining division, the objections raised under Articles 83 and 84 in respect of independent claim 6 were also applicable to the method of claim 1.

Claim 1 is directed to a method the steps of which are essentially in correspondence with the functional features of the different components of the display system defined in independent claim 6. In addition, the

fact that, while independent claim 6 refers to the background portion and to the intensity of the corresponding background features (feature [e]), claim 1 only refers to the background feature(s) in the image of the real-world environment over which the virtual image is overlaid, have no impact on the considerations in points 3.1., 3.1.2 and 3.2 to 3.4 above. Therefore, the objections raised by the examining division in respect of independent claim 6 are, in the board's view, not persuasive for essentially the same reasons set forth in points 3.1 to 3.4 above in respect of claim 1.

3.6 In view of the above considerations, the board concludes that independent claims 1 and 6 of the main request and also of dependent claims 2 to 5 and dependent claims 7 and 8 are clear within the meaning of Article 84 EPC and that the claimed invention is sufficiently disclosed within the meaning of Article 83 EPC.

4. *Remittal for further prosecution*

The reasons given by the examining division in its decision to refuse the European patent application were based only on objections under Articles 83 and 84 EPC. As concluded in point 3.6 above, the claims of the main request meet the requirements of Articles 83 and 84 EPC. The examining division did not decide on the other requirements for patentability, such as novelty and inventive step. In view of this and the primary object of the appeal proceedings to review the decision under appeal in a judicial manner (Article 12(2) RPBA 2020), the board is of the opinion that the remaining issues to be examined for the first time with regard to patentability of the claimed invention according to the

main request would go beyond such a review and cannot be decided with reasonable effort in the appeal proceedings in the case at hand. In these circumstances, the board finds that there are special reasons to set aside the decision under appeal and to remit the case to the examining division for further prosecution (Article 111(1), second sentence, EPC together with Article 11 RPBA 2020).

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance for further prosecution.

The Registrar: The Chairman:

L. Gabor R. Bekkering

Decision electronically authenticated