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**Datasheet for the decision
of 28 May 2013**

Case Number: T 0912/09 - 3.5.04

Application Number: 06118463.6

Publication Number: 1750460

IPC: H04N13/00

Language of the proceedings: EN

Title of invention:

3D graphics processor and autostereoscopic display device
using the same

Applicant:

Samsung Display Co., Ltd.

Headword:

Relevant legal provisions:

EPC 1973 Art. 56

Keyword:

Inventive step - closest prior art - effect not made credible
within the whole scope of claim

Decisions cited:

Catchword:



**Beschwerdekammern
Boards of Appeal
Chambres de recours**

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Case Number: T 0912/09 - 3.5.04

D E C I S I O N
of Technical Board of Appeal 3.5.04
of 28 May 2013

Appellant: Samsung Display Co., Ltd.
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Decision under appeal: **Decision of the Examining Division of the
European Patent Office posted on 5 December 2008
refusing European patent application
No. 06118463.6 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman: F. Edlinger
Members: C. Kunzelmann
C. Vallet

Summary of Facts and Submissions

- I. The appeal is against the decision of the examining division to refuse European patent application No. 06 118 463.6 under Article 97(2) of the European Patent Convention (EPC).
- II. The application was refused on the grounds that claim 1 of the main request then on file was not clear (Article 84 EPC) and that the subject-matter of this claim 1 did not involve an inventive step (Article 56 EPC) over the state of the art in documents

D1: US 6 175 379 B1 and
D2: EP 0 963 122 A2.

The decision under appeal also raised additional objections of insufficient disclosure (Article 83 EPC) concerning claim 1 of the auxiliary request then on file.

- III. The applicant appealed and filed claims of a main and an auxiliary request with the statement of grounds of appeal, as well as new description pages 1 to 5.
- IV. Claim 1 of the main request reads as follows:

"A stereoscopic image display device having a display unit (600) for displaying an image, the stereoscopic image display device comprising:
a 3D graphics data processor (300), and
a driver (500) for receiving the image data from the memory unit, and driving the display unit (600) adapted to display an image corresponding to image data,
wherein the 3D graphics data processor comprises (300):

a geometric engine (330) for generating space coordinate information by using space information of 3D graphics data, the space coordinate information comprising left eye image coordinate information and right eye image coordinate information, the geometric engine (330) comprising:

- a first matrix generator (332) for generating a left eye matrix for the left eye image coordinate information based on a 3D graphics transformation matrix and a user selection parameter, wherein the user selection parameters include an angle (A) formed by a left eye (EL) of an observer, the object (O), and a right eye (ER) of the observer, and a distance (D) between the object (O) and the observer;
- a second matrix generator (333) for generating a right eye matrix for the right eye image coordinate information based on the 3D graphics transformation matrix and the user selection parameter;
- a first matrix operator (335) for performing an operation on the left eye matrix and the space information of the 3D graphics data, and outputting the resulting left eye image coordinate information; and
- a second matrix operator (336) for performing an operation on the right eye matrix and the space information of the 3D graphics data, and outputting the resulting right eye image coordinate information;

a rendering engine (342, 343) adapted to generate view image data using the space coordinate information output from the geometric engine and texture information of the 3D graphics data; and

a memory unit for storing the view image data output from the rendering engine, wherein the display unit is adapted to display a 2D image or a stereoscopic image based on a driving signal of the driver, characterised in that, the rendering engine comprises:

a first engine (342) adapted to generate first view image data of the image data using the left eye image coordinate information output from the first matrix operator (335) and texture information of the 3D graphics data; and
a second engine (343) adapted to generate second view image data of the image data using the right eye image coordinate information output from the second matrix operator (336) and texture information of the 3D graphics data, and
the stereoscopic image display device further comprises a generator selector (331), which alternately transmits the 3D graphics transformation matrix to the first matrix generator (332) and the second matrix generator (333) when the 2D image is to be displayed, and transmits the 3D graphics transformation matrix concurrently to the first matrix generator (332) and the second matrix generator (333) when the stereoscopic image is to be displayed."

- V. Claim 1 of the auxiliary request has the same wording, but with the following text appended at the end, before the full stop:

", such that the image generation process of a subsequent frame starts before an image generation process of a previous frame is completed, when the 3D graphics is displayed as a 2D image".

- VI. The board issued a communication pursuant to Article 15(1) of the Rules of Procedure of the Boards of Appeal (RPBA), annexed to a summons to oral proceedings. In this communication the board *inter alia* expressed the view that the essential disputed issue was whether the solution to the known problem of

providing the possibility of switching between 2D and 3D images specified in claim 1 of the main request involved an inventive step.

- VII. In a letter of reply dated 18 April 2013 the appellant submitted arguments dealing with the board's communication.
- VIII. Oral proceedings before the board were held on 28 May 2013. Clarity and inventive step were discussed. The appellant's final requests were that the decision under appeal be set aside and that a patent be granted on the basis of either the claims of the main request or the auxiliary request, both submitted with the statement of grounds of appeal.
- IX. The reasons given in the decision under appeal relating to the issue of inventive step may be summarised as follows:

The closest prior art was represented by D1. The subject-matter of claim 1 differed from the disclosure of D1 in that a generator selector was adapted to receive a stereoscopic image activation signal, and to alternately transmit the 3D graphics transformation matrix to the first or the second matrix generator in a frame-by-frame manner when the stereoscopic image activation signal indicated that the 2D image was to be displayed. Thus the objective technical problem was whether a person skilled in the art would have been motivated to implement a 2D mode of operation and, if so, whether he would have provided the 3D graphics transformation matrix in an alternating manner. A well-known problem in the field of stereoscopic displays was fatigue or eye strain when observing stereoscopic images. To solve this problem D2 taught

controlling and reducing the parallax quantity to zero, i.e to display a 2D image. A person skilled in the art would have applied this teaching of D2 to the apparatus of D1. The feature of alternately transmitting the 3D graphics transformation matrix to the first and the second matrix generator when the 2D image was to be displayed was not disclosed in D1 or in D2. But it was one of several straightforward possibilities which a person skilled in the art would have selected according to the circumstances. The reason was that in the case of displaying a 2D image the images for the left and the right eye were the same. Hence the rendering of one and the same image on one or the other of the two parallel rendering paths, or alternately switching between the rendering paths, were straightforward solutions, neither of which provided an advantage compared with the other.

- X. The appellant's arguments concerning the issue of inventive step may be summarised as follows:

D2 was concerned with the functionality of switching between 2D and 3D images and thus should be considered as the closest prior art. D1 was concerned with the display of 3D images only. Moreover, the decision under appeal was based on an ex-post analysis because neither D1 nor D2 disclosed a generator selector and the generation of frames of 2D images alternately by two paths. A combination of D1 with D2 (or of D2 with D1) would not have led to the display device of claim 1, because a person skilled in the art would have applied a specific teaching of D2, namely fusing two 3D frames into one 2D frame if a 2D image was to be displayed. A person skilled in the art would not have considered alternating the image processing paths in the context of D1 because this required a generator-selector for

control of data flow and would have introduced unnecessary overhead. The inventors had recognised that avoiding one of the image processing paths being idle could increase the frame rate and thus the image quality.

The auxiliary request clearly sets out that alternately transmitting the 3D graphics transformation matrix results in parallel processing of left eye and right eye image data during a period of overlap when a 2D image is to be displayed.

Reasons for the Decision

1. The appeal is admissible.

Main request

2. Inventive step (Article 56 EPC 1973)

- 2.1 The closest prior art

- 2.1.1 It is established case law that the closest prior art for assessing inventive step according to the problem-solution approach is determined by a number of criteria, one of them being that the closest prior art should be directed to the same purpose or effect as the invention and have the most relevant technical features in common (see Case Law of the Boards of Appeal of the European Patent Office, 6th edition 2010, I.D.3). In the present case, a main purpose of the claimed stereoscopic image display device is to process input 3D graphics data so that either a stereoscopic (i.e. 3D) image or a 2D image may be displayed. The processing of the 3D graphics data makes use of first

and second paths for the left and right eye images respectively.

2.1.2 D2 discloses the functionality of displaying either a stereoscopic image or a 2D image. However, D2 is not specifically concerned with the processing of 3D graphics data. On the other hand, D1 discloses a stereoscopic computer graphics (CG) image generating apparatus and a corresponding stereoscopic television apparatus for displaying a stereoscopic image. However, D1 is not concerned with the functionality of displaying either a stereoscopic image or a 2D image.

2.1.3 In the board's view, the stereoscopic CG image generating apparatus (combined with the corresponding stereoscopic television apparatus) of D1 is the more appropriate starting point (than D2) for the assessment of inventive step of the claimed stereoscopic image display device. The reason is that the apparatus of both D1 and the present application is suitable for processing 3D graphics data (and ultimately displaying images) and makes use of first and second paths for the left and right eye images respectively (see for instance figure 1 of D1). At the priority date of the present application, modifying the apparatus known from D1 by providing it with the additional known functionality of displaying either a stereoscopic image or a 2D image would have been a realistic measure in the development of stereoscopic image display devices having a 3D graphics processor, since it was known (and moreover explicitly indicated in D1) that stereoscopic displays may in some cases make it difficult for the viewer to achieve stereoscopic vision and may thus increase eye strain (see D1, column 2, lines 20 to 27 and line 57 to column 3, line 3). Even without any

further document it would have been clear that displaying 2D images may reduce this eye strain.

2.1.4 D2 however pertains to the broader technical area of stereoscopic imaging systems processing video data. D2 would have required more structural modifications for arriving at the claimed invention, because implementing one of the embodiments of the imaging system of D2 so that it can process specifically 3D graphics data would have required major adaptations to render the embodiment suitable for processing 3D graphics data.

2.1.5 The appellant's argument that D2 was the closest prior art because it was the only document concerned with the functionality of switching between 2D and 3D images did not convince the board. In the present case, this functionality is not the only one which is relevant when determining the closest prior art. In addition, the functionality of processing 3D graphics data also needs to be considered.

2.2 The differing features with respect to D1

2.2.1 It is undisputed that document D1 discloses a stereoscopic image display device having the features specified in the precharacterising portion of claim 1.

2.2.2 Moreover, it is also undisputed that the rendering engine specified in the characterising portion of claim 1, which comprises a first and a second (rendering) engine, has the same function as the two rendering sections for the left eye CG image and the right eye CG image in D1 (see figure 1 and column 1, lines 31 to 35 in conjunction with column 4, lines 44 to 50).

2.2.3 Thus the stereoscopic image display device of claim 1 differs from that known from D1 in a generator selector which

- alternately transmits the 3D graphics transformation matrix to the first matrix generator and the second matrix generator when the 2D image is to be displayed, and

- transmits the 3D graphics transformation matrix concurrently to the first matrix generator and the second matrix generator when the stereoscopic image is to be displayed.

2.3 The technical problem solved

2.3.1 The feature of the generator selector specified in claim 1 has the technical effect of providing the possibility of displaying 2D images. Thus the objective technical problem may be formulated as "how to introduce a 2D mode into the display of D1" (as argued by the appellant on page 4 of the statement of grounds of appeal).

2.3.2 In this context the board notes that the problem of introducing a 2D mode in a stereoscopic display was known at the priority date of the present application. D2 sets out that "It is generally said that the eyes are more likely to become fatigued when observing a stereoscopic image comparing to the case of observing an ordinary two-dimensional image" (see paragraph [0004]) and discloses that "for the purpose of not producing such effects as fatigue on the observer" it was an object of the invention disclosed in D2 to provide a visual image system having "a suitable control on displaying method of visual image such as switching of stereoscopic image to two-dimensional image" (see paragraph [0009]).

2.3.3 The appellant's argument that the generator selector specified in claim 1 had the effect of allowing the frame rate to be increased, and thus solved another problem, did not convince the board that the objective technical problem had to be formulated differently. The reasons are the following:

- The application as published specifies in paragraph [0080] that "a display speed of the 2D image is increased and an image quality may be increased." This effect, however, is a result of the fact that "an image generation process of a subsequent frame may be started before an image generation process of a previous frame is completed when the 3D graphics is displayed as a 2D image by using the 3D graphics data in the stereoscopic image display device according to the exemplary embodiment". Thus the possible increase of the frame rate is related to the particular embodiment described. Indeed, alternately transmitting the 3D graphics transformation matrix to the first and the second matrix generator *per se* does not change the frame rate.

- A person skilled in the art would understand that the overall processing time for two subsequent 2D images may be reduced if one of the processing paths is used for the first (odd-numbered) frame and the other path is used for the subsequent (even-numbered) frame while the first frame is being processed (and first and second memories alternately output the subsequent frames; see figures 3 and 5 of the application). This is the usual advantage of parallel over serial processing. Thus, in the autostereoscopic display described in the present application, parallel data processing may be possible and consequently, if the

generator selector is appropriately arranged, the associated advantages may occur. However, in this respect the application does not disclose any details.

- Whether the frame rate may be increased is also dependent on the time required for producing a frame from the input 3D graphics data (and other required inputs). However, the application does not disclose any details about this either.

2.4 The indications given in D2

2.4.1 D2 discloses several embodiments of a stereoscopic imaging system which allow the switching of a stereoscopic image to a 2D image. But the disclosure is not limited to these specific embodiments; the general teaching that eye fatigue may be reduced by a suitable control which allows switching from a stereoscopic image to a 2D image is also part of the disclosure of D2 (see, for instance, paragraph [0009]).

2.4.2 A person skilled in the art, starting from document D1 and faced with the objective problem of how to introduce a 2D mode into the display of D1 (see point 2.3.1 above), would consider this general teaching and provide a suitable control which allows switching from a stereoscopic image to a 2D image.

2.4.3 In the context of D1 the right-eye CG image and the left-eye CG image are produced in parallel processing paths, which each include a "projection transformation section" and a "rendering section" (see, for instance, figure 1). Moreover, for the display of a stereoscopic image, both the right-eye CG image and the left-eye CG image must be produced per frame, whereas for the display of a 2D image it is sufficient to produce one

or the other of the right- and left-eye CG image per frame.

- 2.4.4 Details as to the timing of the individual image processing operations are not considered in D1. However, for the display of stereoscopic images both the right-eye CG image and the left-eye CG image must be available so that they can both be displayed with the display under consideration (such as autostereoscopic, anaglyph, using polarising glasses, or time-multiplexing using shutter glasses). For some of these displays (in particular anaglyph and using polarising glasses) both images may be displayed concurrently, so that it would be obvious for a person skilled in the art to provide a suitable control which allows concurrent transmission of the 3D graphics transformation matrix to the first matrix generator and the second generator in the display device of D1 (and thus concurrent production of the two images).
- 2.4.5 For the display of 2D images it is sufficient to generate and display the same image for both eyes. Again, the details would be dependent on the display under consideration. Under these circumstances, in D1 the image processing path may be selected according to the circumstances. In this respect the board agrees with the decision under appeal, point 10.5. Thus it would have been obvious for a person skilled in the art to provide a suitable control which allows alternating transmission of the 3D graphics transformation matrix to the first matrix generator and the second generator in the display device of D1.
- 2.4.6 Hence, a person skilled in the art would have arrived at the display device of claim 1 in an obvious manner.

- 2.5 The appellant's arguments did not convince the board that the decision under appeal was incorrect. The reasons are as follows:
- 2.5.1 The appellant argued that the decision under appeal was based on an ex-post analysis, because neither D1 nor D2 disclosed a generator selector and the generation of frames of 2D images alternately by two paths. However, the technical effect of these features is that of providing the possibility of displaying 2D images or stereoscopic images and allowing parallel processing instead of serial processing. Any further effects, such as an increase of the frame rate, may or may not occur, depending on circumstances, such as the type of display under consideration (see point 2.3.3 above). Under these circumstances the decision under appeal was correct to find that the feature of alternately transmitting the 3D graphics transformation matrix to the first and the second matrix generator when the 2D image was to be displayed was one of several straightforward possibilities.
- 2.5.2 The appellant also argued that a combination of D1 and D2 would not have led to the display device of claim 1, because a person skilled in the art would have applied a specific teaching of D2, namely fusing two 3D frames into one 2D frame if a 2D image was to be displayed. However, a person skilled in the art would also have considered the general teaching in D2 (see points 2.4.1 and 2.4.2 above). The board agrees with the appellant that the specific solutions envisaged in the embodiments of D2, such as reducing the parallax between the left-eye image and the right-eye image, or gradually reducing it to zero (thus displaying a 2D image), or instantly switching from a stereoscopic image to a 2D image (see D2, paragraph [0045]), require

the existence of frames to be processed or at least selected. But this results from the fact that D2 is concerned with how to change from a stereoscopic image to a 2D image, not with the production of the underlying frames. In a case where 3D graphics is to be displayed as a 2D image, only the data of one frame need to be generated and displayed for both eyes. It is thus sufficient to transmit the 3D graphics transformation matrix alternately to the path processing the current frame. Thus, a person skilled in the art would have applied this general teaching of D2 instead of applying one specific embodiment.

2.5.3 The appellant also argued that a person skilled in the art would not have considered alternating the image processing paths in the context of D1 because this introduced unnecessary overhead. However, the appellant failed to show how this problem was overcome in the present application. In any case, the board does not see any features in claim 1 which would solve this problem. Moreover, this argument does not take into account that for some autostereoscopic displays (see D1, column 14, lines 53 to 55) using only one of the image processing paths would result in no image being presented to one of the viewer's eyes (unless further measures were taken). Thus, there are circumstances in which this overhead is not unnecessary.

2.5.4 The appellant also argued that the inventors had recognised that avoiding the image processing paths being idle could be used to increase the frame rate and thus the image quality. However, this is a generally known advantage which may be obtained by parallel processing instead of serial processing of images. Moreover, the claimed display device does not have an

increased frame rate unless further measures are taken (see point 2.3.3 above).

Auxiliary request

3. Inventive step (Article 56 EPC 1973)
 - 3.1 Claim 1 of the auxiliary request comprises the additional feature "such that the image generation process of a subsequent frame starts before an image generation process of a previous frame is completed, when the 3D graphics is displayed as a 2D image." Thus the device of claim 1 of the auxiliary request is arranged for parallel processing of left eye and right eye image data during a period of overlap when a 2D image is to be displayed.
 - 3.2 However, as analysed in point 2.3.3 above, this additional feature has the effect of allowing an increase of the frame rate only in specific embodiments. Even in these cases, the benefit of an increased overall processing speed by using the two paths for processing two subsequent images in parallel would be immediately apparent to a person skilled in the art and could be used for increasing the frame rate or for any other purpose not specified in claim 1, such as increasing the image quality (see paragraph [0080] of the published application). Thus the image display device specified in the broad terms of claim 1 of the auxiliary request was obvious to a person skilled in the art.
 - 3.3 The appellant's arguments with respect to the auxiliary requests are the same as for the main request, for the particular case that overlapping image generation was

considered, and thus do not lead the board to a different conclusion.

4. In view of the above the board finds that the subject-matter of claim 1 of both the main and auxiliary request does not involve an inventive step (Article 56 EPC 1973). Thus the decision under appeal cannot be set aside, and the appeal is to be dismissed.

5. Therefore, the issues of clarity (Article 84 EPC) and sufficiency of disclosure (Article 83 EPC) raised in the decision under appeal need not be decided.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



K. Boelicke

F. Edlinger

Decision electronically authenticated