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Datasheet for the decision of 13 December 2012

Case Number: T 0732/09 - 3.5.04

Application Number: 06116595.7

Publication Number: 1742489

IPC: H04N13/00

Language of the proceedings: EN

Title of invention:
Image display device and graphic processor for stereoscopic display of 3D graphic objects

Applicants:
Samsung Display Co., Ltd.
Nexuschips Co., Ltd.

Headword:

Relevant legal provisions:
EPC Art. 123(2)
EPC 1973 Art. 84, 56

Keyword:
Inventive step - after amendment

Decisions cited:

Catchword:

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Case Number: T 0732/09 - 3.5.04

D E C I S I O N
of the Technical Board of Appeal 3.5.04
of 13 December 2012

Appellant I: (Applicant 1)	Samsung Display Co., Ltd. 95, Samsung 2 Ro Giheung-Gu Yongin-City, Gyeonggi-Do, 446-711 (KR)
Appellant II: (Applicant 2)	Nexuschips Co., Ltd. A701, 7-floor, west-building IT venture tower, 78, Garakbon-dong Songpa-gu, Seoul (KR)
Representative:	Hengelhaupt, Jürgen Gulde Hengelhaupt Ziebig & Schneider Patentanwälte - Rechtsanwälte Wallstraße 58/59 10179 Berlin (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted 18 December 2008 refusing European patent application No. 06116595.7 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman: F. Edlinger
Members: R. Gerdes
C. Vallet

Summary of Facts and Submissions

I. The appeal is against the decision of the examining division to refuse European patent application No. 06 116 595.7.

II. The examining division held in the decision under appeal that the application did not comply with Article 56 EPC because the claimed subject-matter of the main request and the first and second auxiliary requests was obvious in view of:

D1: WO 00/00934 A2

III. The applicants appealed against this decision and filed amended claims.

IV. With a letter dated 13 November 2012, the appellants submitted new claims in reply to the board's communication accompanying the summons to oral proceedings.

V. Oral proceedings were held before the board on 13 December 2012. At the end of the oral proceedings the appellants requested that the decision under appeal be set aside and that a patent be granted in the following version:

Description:

Pages 1 to 5 and 12 received during oral proceedings of 13 December 2012

Pages 6 to 11 and 13 as originally filed.

Claims:

No. 1 to 6 received during oral proceedings of 13 December 2012.

Drawings:

Figures 1 to 3 as originally filed.

VI. Independent claims 1 and 4 read as follows:

"1. A stereoscopic image display device comprising:
a controller (100) for receiving three dimensional (3D) graphic data and a synchronization signal, and for outputting a control signal and the 3D graphic data, wherein the control signal comprises a 3D activation signal for indicating whether to display a 3D stereoscopic image;
a 3D graphic processor (400) for generating a plurality of stereoscopic matrices used to generate 3D stereoscopic image data for a plurality of viewing points, and, if the 3D graphic data is received along with the 3D activation signal from the controller (100), transforming the 3D graphic data into the 3D stereoscopic image data using the plurality of stereoscopic matrices, and if the 3D graphic data is received without the 3D activation signal, processing the 3D graphic data to be displayed as a 2D image;
a driver (200) for generating a driving signal based on the *3D stereoscopic* image data *or the 2D image* output from the 3D graphic processor (400) and the control signal; and
a display unit (300) for displaying a 2D or a 3D stereoscopic image according to the driving signal by using the 3D activation signal,
wherein the 3D graphic processor (400) comprises:
a geometric engine (410) *for generating triangle shaped coordinates information* for a plurality of viewing points by using user selection parameters, a 3D transformation matrix and a 3D information including vertex coordinate and texture coordinate information *contained in the 3D graphic data*;
a rendering engine (420) for generating *left eye and right eye* image data for the respective viewing points

by rendering the *triangle shaped* image coordinates for the plurality of viewing points *generated by the geometric engine (410)*; and
a frame memory (430) for storing in each frame the generated image data for the respective viewing points, and
wherein the geometric engine comprises:
an image index counter (412) for outputting an image index indicating the image data for a currently processed viewing point among the plurality of viewing points;
a matrix generator (413) for generating the plurality of stereoscopic matrices after receiving the image index and the 3D transformation matrix for displaying the 3D graphic data as a two-dimensional (2D) image, *wherein* the matrix generator (413) is adapted to receive the user selection parameters inputted by a user, the user selection parameters including at least one of a spacing between eyes, and forward angles of the respective eyes, and generates the stereoscopic matrices using the inputted user selection parameters; and
a matrix calculator (416) for outputting the *triangle shaped* image coordinate*s* after performing *an* operation on the matrices output by the matrix generator (413) and the 3D graphic data,
wherein the 3D graphic processor (400) further comprises:
a first multiplexer (415) for receiving the stereoscopic matrices output by the matrix generator (413) and the 3D transformation matrix, selecting one matrix among the received stereoscopic matrices and the 3D transformation matrix according to the 3D activation signal, and outputting the selected matrix to the matrix calculator (416), *wherein the image index counter comprises a left/right index*

counter (412) for outputting a left/right index indicating whether an image being processed is a left eye image or a right eye image, and wherein the matrix generator (413) generates a left eye stereoscopic matrix or a right eye stereoscopic matrix according to the left/right index; and
a request signal outputting unit (418) comprising:
an AND processor (414) for receiving a request signal generated by the rendering engine (420) and the left/right index, and
a second multiplexer (417) for selecting one among the request signal generated by the rendering engine (420) and an output of the AND processor (414) according to the 3D activation signal, such that the second multiplexer (417) outputs:
an output signal of the AND processor (414) when the 3D activation signal (a) is in the activated state, and the request signal (b) when the 3D activation signal (a) is in the inactivated state,
wherein the signal output from the second multiplexer (417) is transmitted to the controller (100) for requesting a next draw command according to the left/right index and the 3D activation signal."

and

"4. A method for driving a stereoscopic image display device comprising:
receiving three dimensional (3D) graphic data and a synchronization signal, *inputting user selection parameters by a user,* the user selection parameters including at least one of a spacing between eyes, and forward angles of the respective eyes;
transmitting a control signal and the 3D graphic data to a 3D graphic processor (400), wherein the control

signal comprises a 3D activation signal for indicating whether to display a 3D stereoscopic image;
in a 3D graphic processor, generating left and right eye stereoscopic matrices used to generate 3D stereoscopic image data for a plurality of viewing points, and if the 3D graphic data is received along with the 3D activation signal from the controller (100), transforming the 3D graphic data into the 3D stereoscopic image data using the plurality of stereoscopic matrices, and if the 3D graphic data is received without the 3D activation signal, processing the 3D graphic data to be displayed as a 2D image;
wherein the 3D graphic processor *step* comprises *the sub-steps of*:
generating triangle shaped coordinates information for a plurality of viewing points in a geometric engine (410) by using the user selection parameters, a 3D transformation matrix and a 3D information including vertex coordinate and texture coordinate information *contained in the 3D graphic data*;
generating *left eye and right eye* image data for the respective viewing points in a rendering engine (420) *by rendering the triangle shaped image coordinates for the plurality of viewing points generated by the geometric engine (410)*; and a frame memory (430) for storing in each frame the generated image data for the respective viewing points; wherein the geometric engine comprises:
generating the plurality of stereoscopic matrices in a matrix generator (413) after receiving a 3D transformation matrix for displaying the 3D graphic data as a two-dimensional (2D) image;
outputting the triangle shaped image coordinates by a matrix calculator (416) after performing an operation on the matrices output by the matrix generator (413) and the 3D graphic data;

generating a driving signal based on *the 3D stereoscopic* image data *or the 2D image* output from the 3D graphic processor (400) and the control signal; and displaying a 2D or a 3D stereoscopic image according to the driving signal,
receiving the stereoscopic matrices output by the matrix generator (413) and the 3D transformation matrix in a first multiplexer (415) of the 3D graphic processor (400),
selecting one matrix among the received stereoscopic matrices and the 3D transformation matrix according to the 3D activation signal, and
outputting the selected matrix to the matrix calculator (416), and in addition:
outputting a left/right index by a left/right index counter (412) indicating whether an image being processed is a *left eye image or a right eye* image,
generating a left eye stereoscopic matrix or a right eye stereoscopic matrix by the matrix generator (413) according to the left/right index; and
outputting a draw command request signal to the controller (100) for requesting a next draw command according to the left/right index and the 3D activation signal by a request signal outputting unit (418) comprising an AND processor (414) for receiving a request signal generated by the rendering engine (420) and the left/right index, and a second multiplexer (417) for selecting one among the request signal generated by the rendering engine (420) and an output of the AND processor (414) according to the 3D activation signal, such that the second multiplexer (417) outputs an output signal of the AND processor (414) when the 3D activation signal (a) is in the activated state, and outputs the request signal (b) when the 3D activation signal (a) is in the inactivated state, wherein the signal output from the second

multiplexer (417) is transmitted to the controller (100)."

[The text in italics indicates amendments that have been made to the independent claims 1 and 10 of the second auxiliary request underlying the decision under appeal.]

VII. The reasoning of the examining division - as far as it is relevant for the amended claims - can be summarised as follows.

D1 disclosed a mode control signal, "which changes management of a 2D frame buffer 31 from one viewpoint into left and right viewpoints for the stereoscopic display". Thus, the 3D activation signal of claim 1 was implicit in D1. The application essentially related to an apparatus being specified using a "different terminology and a different mixture of hardware and software in comparison to the design disclosed in D1".

D1 did not disclose a first multiplexer for selecting one of the stereoscopic matrices or the 3D transformation matrix in accordance with the 3D activation signal. Such a design would have been obvious in view of D1 and the normal design options for a skilled person.

In an obiter dictum the examining division also noted that the passage "a controller (100) for receiving three-dimensional (3D) graphic data contained within a two-dimensional image" was not originally disclosed in the application as filed (Article 123(2) EPC). Moreover, the presence of several independent claims directed to an apparatus contravened the requirement of conciseness (Article 84 EPC). The feature relating to

"a request signal outputting unit ..." was unclear, because it failed "to clearly define which state the draw command request signal assumes 'according to the left/right index and the 3D signal'". The command request signal also seemed "to depend on an apparently essential request signal (b) supplied from the rendering engine" (section III of the decision under appeal).

Reasons for the Decision

1. The appeal is admissible.

2. The present independent claims are based on the claims of the second auxiliary request underlying the decision under appeal. Amendments have been made to clearly designate the input/output data of the geometric engine, the rendering engine, and the driver. Furthermore, details of the image index counter and its functionality have been added to the claims. Finally, the request signal outputting unit - operating on the request signal generated by the rendering engine so as to request a next draw command - has been specified in detail in the independent claims.

3. Article 123(2) EPC

3.1 The expression "a controller (100) for receiving three dimensional (3D) graphic data contained within a two dimensional image (2D)" contained in claim 1 of all requests underlying the decision under appeal was replaced by "a controller (100) for receiving three dimensional (3D) graphic data". This expression is disclosed in claim 1 and page 2, lines 23 and 24 of the application as filed. The amendments of claim 1 relating to the matrix generator being adapted "to

receive the user selection parameters ..." are derivable from claim 4 and page 4, lines 33 and 34. The amendments of the passage relating to "a driver (200) for generating ..." are disclosed on page 7, lines 23 to 26. The final part of claim 1 relating to the left/right index counter, the matrix generator and the request signal outputting unit are disclosed in figure 3 together with page 11, line 1 to page 12, line 11 of the application as filed.

3.2 Corresponding amendments have been made to independent claim 4. Hence, the board finds that the claims of the appellants' sole request do not contain subject-matter which extends beyond the content of the application as filed and thus complies with Article 123(2) EPC.

4. *Clarity (Article 84 EPC 1973)*

4.1 The set of claims according to the sole request of the appellants contains two independent claims, with claim 1 being directed to a device and claim 4 being directed to the corresponding method. As set out above (see point 2), the independent claims have been amended to specify the condition for requesting a next draw command. The claims also explicitly refer to the "request signal generated by the rendering engine". Hence, the examining division's objections regarding lack of conciseness and lack of clarity have been resolved (see point VII above, last paragraph).

4.2 The board has no further objection regarding the clarity of the claims.

5. Inventive Step (Article 56 EPC 1973)

5.1 The board agrees with the appellants that D1 reflects the closest prior art with respect to the subject-matter of claim 1.

5.2 D1 discloses a computer system adapted to generate two-dimensional (2D) as well as three-dimensional (3D) computer graphics. The computer system includes a "software portion" comprising an application program, a 3D rendering engine and a display driver. In order to generate 3D stereoscopic images a stereoscopic filter, which is implemented as a software module, intercepts function calls to the display driver and converts 3D content into "stereoscopic image data for a left eye viewpoint and a right eye viewpoint". The stereoscopic image data are forwarded to a 3D acceleration driver and a hardware 3D accelerator containing frame buffers to store the stereoscopic image data. The data may subsequently be displayed on a stereoscopic display (see D1, page 1, lines 20 to 29, page 2, lines 28 to 34, page 4, line 8 to page 5, line 20).

The computer system provides mode set entry points to "enable a special stereoscopic mode to be set. This changes the management of the 2D frame buffer 31 from one viewpoint into left and right viewpoints for the stereoscopic display" (see page 5, lines 26 to 28). In its stereoscopic, i.e. 3D modes, the stereoscopic filter receives rendering requests from the 3D rendering engine with "3D objects represented as arguments", the objects being represented by "polygons, usually triangular that tile the object surface to form a 3D object" (see page 7, lines 16 to 22). The filter employs viewer models including parameters such as a

user's eye distance d to recalculate the "XYZ location of the 3D object" with respect to the left and right eye focal points. For this purpose 3D object coordinates are transformed to account for the left and right eye position, respectively. Subsequently these transformed object coordinates are "rendered into the eye view 2D buffer" or in other words the 3D acceleration driver renders "the left eye object into the left frame and the right eye object to the right frame in the frame buffer 31" (see page 8, line 30 to page 10, line 13 and claims 6 and 11).

5.3 Claim 1 of the present application relates to a stereoscopic image display device, which in a first mode allows for the display of 3D graphic data as 3D stereoscopic image data. In a second mode the 3D graphic data may be displayed as 2D image data. A 3D activation signal is used to select either the 3D or 2D display mode.

5.4 Claim 1 is distinguished from D1 in that it recites in detail components of a geometric engine which serve to realise the 2D and 3D display modes and to switch between these modes in dependence on the 3D activation signal. In particular, D1 does not disclose the left/ right index counter and all components of the request signal outputting unit, which serves to request a next draw command based on the request signal of the rendering engine and the selected display mode.

5.5 The specific implementation of the geometric engine results in an operation that - in the 3D display mode - suppresses every second request from the rendering engine for the next draw command in dependence on the state of the 3D activation signal and the left/right index counter. In contrast, in 2D display mode the

request signal is passed without further modification to the controller. Hence, the geometric engine serves to adapt the request signal output by the rendering engine in accordance with the different requirements in 2D or 3D display mode. Similarly, the operation of the matrix generator and the first multiplexer is controlled by the 3D activation signal and the left/right index counter in such a way as to pass the adequate transformation matrix to the matrix calculator.

5.6 Starting from D1 as closest prior art the technical problem is therefore regarded as how to implement 2D and 3D display modes for 3D graphic data while restricting modifications of the rendering engine to a minimum.

5.7 Neither D1 nor any other of the documents on file suggests or hints at the particular implementation specified in claim 1 using the 3D activation signal and the left/right index counter for control of data supplied to the geometric engine as well as for the request signal from the rendering engine to the controller. In this context it should be noted that the stereoscopic filter in D1 is used to implement the functionality corresponding to the 3D display mode. However, the 2D display mode is realised without intervention of the stereoscopic filter (see D1, page 8, lines 14 to 16). Thus, the concept of the geometric engine according to claim 1 realising both display modes by common components being selected in dependence on the 3D activation signal differs substantially from that of the stereoscopic filter.

Therefore, the subject-matter of claim 1 was not obvious to a person skilled in the art starting from

D1. The examining division has not indicated that the subject-matter now claimed would have been obvious starting from any other available prior-art document, or by combining the teaching of any document with that of D1. Nor does the board see reasons to raise such an objection. The board thus judges that, having regard to the state of the art, the subject-matter of claim 1 involves an inventive step (Article 56 EPC 1973).

5.8 The above reasoning applies likewise to independent claim 4 which is directed to a method for driving a stereoscopic image display device corresponding to the device of claim 1. Claims 2 and 3 as well as claims 5 and 6 depend on claims 1 and 4, respectively.

6. The board sees no other objection which would prejudice the grant of a patent.

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 with the order to grant a patent in the following version:

Description:
Pages 1 to 5 and 12 received during oral proceedings of 13 December 2012
Pages 6 to 11 and 13 as originally filed.
Claims:
No. 1 to 6 received during oral proceedings of 13 December 2012.
Drawings:
Figures 1 to 3 as originally filed.

The Registrar: The Chairman:

K. Boelicke F. Edlinger

Decision electronically authenticated