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(72) Inventor; and

(71) Applicant : JENKINS, Barry, Lynn [US/US]; 1515 Mahantongo Street, Pottsville, PA 17901 (US).

(74) Agent: KULBASKI, James, J.; Oblon, Spivak, Mccllelland, Maier & Neustadt, L.L.P., 1940 Duke Street, Alexandria, VA 22314 (US).

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(54) Title: SYSTEM AND METHOD OF FROM-REGION VISIBILITY DETERMINATION AND DELTA-PVS BASED CONTENT STREAMING USING CONSERVATIVE LINEARIZED UMBRAL EVENT SURFACES

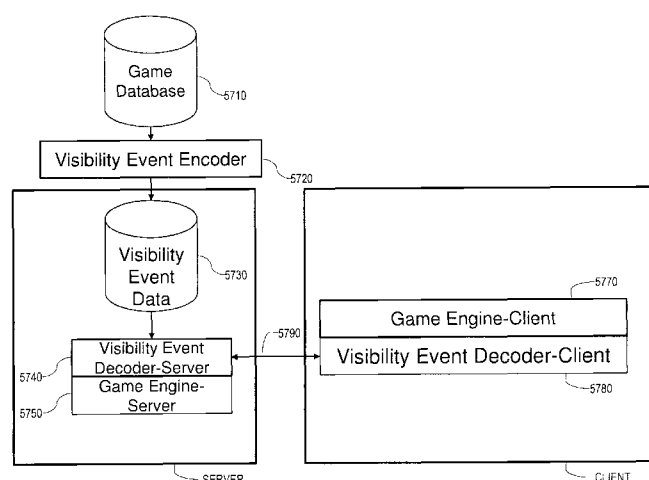


FIG. 57

(57) Abstract: A method determines a set of mesh polygons or fragments of the mesh polygons visible from a view region having a plurality of view region vertices, the mesh polygons forming polygon meshes. The method includes determining at least one supporting polygon between the view region and the polygon meshes. The method further includes constructing at least one wedge from the at least one supporting polygon, the at least one wedge extending away from the view region beyond at least the polygon meshes. Further, the method includes determining one or more intersections of the wedges with the mesh polygons. Also, the method includes determining the set of the mesh polygons or fragments of the mesh polygons visible from the view region using the determined one or more intersections of the at least one wedge with the polygon meshes.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 11/42309

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - G06T 15/00 (2011.01)

USPC - 345/419

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

USPC: 345/419

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
IPC: G06T 15/00; USPC: 345/653; 345/679; 345/419; 348/42 (keyword limited; terms below)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PubWEST (USPT, PGPB, EPAB, JPAB); Google Scholar; Google Patents

Keywords: Polygon mesh; wedge; triangle; view region; plane; encoder; decoder; vertex

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 2008/0180440 A1 (STICH) 31 July 2008 (31.07.2008), entire document, especially; para [0016], [0024]-[0034], [0070], [0071], [0073], [0086]-[0091], [0100]-[0104], [0106], [0127]-[0139], [0143], [0144], [0147], [0152]-[0155], [0160], [0170], [0174], [0176]	34-40, 58, 60, 62, 64, 66, 68, 70, 71, 75-104, 109-119 1-33, 41-57, 59, 61, 63, 65, 67, 69, 72-74, 105-108
X --- Y	US 2007/0206008 A1 (KAUFMAN et al.) 06 September 2007 (06.09.2007), entire document, especially; para [0228], [0268], [0272], [0291], [0292], [0383], [0413], [0431], [0447], [0448], [0466], [0474], [0478], [0479]	132, 133 20, 105-108
Y	US 2010/0060640 A1 (MELIKIAN et al.) 11 March 2010, entire document, especially; para [0040], [0062]-[0079], [0118]-[0131], [0163]-[0172]	1-33, 41-56, 72-74
Y	US 2002/0167518 A1 (MIGDAL et al.) 14 November 2002 (14.11.2002), entire document, especially; para [0015], [0016], [0065], [0069]	57, 59, 61, 63, 65, 67, 69
Y	US 2010/0045670 A1 (O'BRIEN et al.) 25 February 2010 (25.02.2010), entire document, especially; para [0002], [0007], [0008], [0035], [0036], [0050]-[0055], [0072]-[0079]	120-131, 134-155

☒ Further documents are listed in the continuation of Box C.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

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Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
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Authorized officer:

Lee W. Young

PCT Helpdesk: 571-272-4300

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 11/42309

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,999,187 A (DEHMLow et al.) 07 December 1999 (07.12.1999), entire document, especially; col. 1, ln 48 - col. 2, ln 6; col. 9, ln 39-55; col. 10, ln 27 - col. 11, ln 6; col. 14, ln 60 - col. 15, ln 16; col. 16, ln 60 - col. 17, ln 20	120-131, 134-155
Y	US 2009/0276541 A1 (LOCK et al.) 05 November 2009 (05.11.2009), entire document, especially; para [0025], [0026], [0034], [0037], [0039]	127
A	US 2009/0207169 A1 (WAKAYAMA) 20 August 2009 (20.08.2009), entire document	1 - 155
A	US 5,553,206 A (MESHKAT) 03 September 1996 (03.09.1996), entire document	1 - 155
A	US 2006/0082571 A1 (MCDANIEL) 20 April 2006 (20.04.2006), entire document	1 - 155
A	EL-SANA et al., 'Integrating Occlusion Culling with View-Dependent Rendering' Presented at IEEE Visualization 2001, October 26, 2001, Retrieved online at: < http://www.tecgraf.puc-rio.br/~hofmam/public/artigos/IEEE%20Vis/2001/Integrating%20occlusion%20culling%20with%20view-dependent%20rendering.pdf >	1 - 155
A	LLOYD et al., 'Horizon Occlusion Culling for Real-time Rendering of Hierarchical Terrains,' IEEE Visualization 2002, November 1, 2002, Retrieved online at: < http://www.evl.uic.edu/cavern/rg/20040525_renambot/Visualization-papers/papers/02/01183801.pdf >	1 - 155
A	DIEPSTRATEN et al. 'Remote Line Rendering for Mobile Devices' Computer Graphics International, 2004 Proceedings, 19 June 2004, Retrieved online at: < http://ieeexplore.ieee.org/xpl/freeabs_all.jsp?arnumber=1309247 >	1 - 155

INTERNATIONAL SEARCH REPORT

International application No.

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Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1.

Group 1: claims 1-119 and 132-133 directed to methods and systems and non-transitory computer readable storage media including instructions for determining a set of mesh polygons or fragments of said mesh polygons.
Group 2: claims 120-131 and 134-155 directed to methods and systems and non-transitory computer readable storage media including instructions for controlling navigation-based pre-fetch sending of graphics information.

The inventions listed as Groups 1 and 2 do not relate to a single general inventive concept under PCT Rule 13.1 because under PCT Rule 13.2 they lack the same or corresponding technical features for the following reasons:
Group 2 does not include the inventive concept of determining a set of mesh polygons or fragments of said mesh polygon of Group 1.
Group 1 does not include the inventive concept of controlling navigation-based pre-fetch sending of graphics information of Group 2.
Since each of these technical features are not common to the other group, unity of invention is lacking.

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☒ No protest accompanied the payment of additional search fees.