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REQUEST FOR FILING A PROVISIONAL APPLICATION FOR PATENT
UNDER 37 CFR §1.53 (c)

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TITLE OF THE INVENTION		
OPTIMIZATION OF RENDERING MEMORY USAGE IN FAST QUALITY BUILD-UP TARGET IMAGE TRANSFER OVER LIMITED AND NARROWBAND COMMUNICATION NETWORKS		
<input checked="" type="checkbox"/> Direct all correspondence to Customer Number <u>23488</u> .		
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ENCLOSED APPLICATION PARTS (check all that apply)		
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<input type="checkbox"/> Declaration		<input type="checkbox"/> Assignment and Cover Sheet
<input checked="" type="checkbox"/> Other: <u>Return-Receipt Post Card.</u>		
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<input checked="" type="checkbox"/> A check is enclosed to cover the Filing Fees.		
<input checked="" type="checkbox"/> The Commissioner is hereby authorized charge Filing Fees or credit any overpayment to: Deposit Account Number: <u>50-0890</u> .		
<input checked="" type="checkbox"/> This invention was <u>not</u> made by or under contract with a US Government agency.		
<input type="checkbox"/> US Government agency and Contract: _____		
Signature: <u>Gerald B Rosenberg</u>	Date: <u>December 26, 2000</u>	
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1 OPTIMIZATION OF RENDERING MEMORY USAGE IN
2 FAST QUALITY BUILD-UP TARGET IMAGE TRANSFER
3 OVER LIMITED AND NARROWBAND
4 COMMUNICATION NETWORKS
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8 Inventors:

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10 Yoni Lavi
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15 Background of the Invention

16 The present invention is generally related to the delivery of high-resolution
17 highly featured graphic images over limited and narrowband communications
18 channels.
19

20 Summary of the Invention

21 The objective is to display a two-dimensional pixel map, a 16-Bit RGB color
22 image in the preferred embodiments, of very large dimensions and permitting the
23 viewing of the image from a dynamic three-dimensional viewpoint. Multiple such
24 images are remotely hosted for on-demand selection and transfer to a client
25 system for viewing.

1 Images, as stored by the server, may individually range from gigabytes to
2 multiple terabyte in total size. A correspondingly large server storage and
3 processing system is contemplated. Conversely, client systems are contemplated
4 to be conventional personal computer systems and, in particular, mobile, cellular,
5 embedded, and handheld computer systems, such as personal digital assistants
6 (PDAs) and internet-capable digital phones, with relatively limited to highly
7 constrained network communications capabilities. For most wireless applications,
8 conventional narrowband communications links have a bandwidth of less than
9 approximately three kilobytes of data per second. Consequently, transmittal of
10 entire images to a client system in reasonable time is infeasible as a practical
11 matter.

12 Description of the Invention

13 Overview:

14 For purposes of the present invention, each image (Figure 1) is at least
15 logically defined in terms of multiple grids of image parcels with various levels of
16 resolutions (Figure 2) that are created through composition of information from
17 all level of resolutions, and stored by the server to provide an image for transfer
18 to a client system (Figure 3). Composed and separate static and dynamically
19 created layers are transferred to client system in parcels in a program selectable
20 order to optimize for fast quality build-up of the image presented to a user of the
21 client system, particularly when the parcels are streamed over a narrowband
22 communication link.

23 The multiple layers of an image allow the selectivity to incorporate
24 topographical, geographical, orientational, and other terrain and mapping
25

1 related information into the image delivered. Other layers, such as geographic
2 grids, graphical text overlays, and hyperlink selection areas, separately provided
3 or composed, aid in the useful presentation and navigation of the image as
4 presented by the client system and viewed by the user.

5 Compositing of layers on the server enables the data transfer burden to be
6 reduced, particularly in analysis of the requirements and capabilities of the client
7 system and the connecting communications link. Separate transfer of layers to the
8 client system allows the client system selectivity in managing and presentation of
9 the data to the user.

10 The system and methods of the present invention are designed to, on
11 demand, select, process and immediately transfer data parcels to the client
12 system, which immediately processes and displays a low-detail representation of
13 the image requested by the client system. The system and methods immediately
14 continue to select, process and sequentially transfer data parcels that, in turn, are
15 processed and displayed by the client system to augment the presented image
16 and thereby provide a continuously improving image to the user.

17 Selection of the sequentially transferred data is, in part, dependent on the
18 progressive translation of the three-dimensional viewpoint as dynamically
19 modified on the client system during the transfer process. This achieves the
20 above-stated objective while concurrently achieving a good rendering quality for
21 continuous fly-over of the image as fast as possible, yet continuously building the
22 image quality to the highest resolution of the image as stored by the server.

23 To optimize image quality build-up over limited and narrowband
24 communication links, the target image, as requested by the client system, is
25 represented by multiple grids of 64x64 image pixels (Figure 4) with each grid

1 having some corresponding level of detail. That is, each grid is treated as a
2 sparse data array that can be progressively revised to increase the resolution of
3 the grid and thereby the level of detail presented by the grid. The reason for
4 choosing the 64x64 pixel dimension is that, using current image compression
5 algorithms, a 16-bit 64x64 pixel array image can be presented as a 2KByte data
6 parcel. In turn, this 2KByte parcel is the optimal size, subject to conventional
7 protocol and overhead requirements, to be transmitted through a 3KByte per
8 second narrowband transmission channel. Using a smaller image array, such as
9 32x32, would create a 0.5KByte parcel, hence causing inefficiencies due to packet
10 transmission overhead, given the nature of current wireless communications
11 protocols.

12 Image array dimensions are preferably powers of two so that they can be
13 used in texture mapping efficiently. Each parcel, as received by the client system,
14 is preferably immediately processed and incorporated into the presented image.
15 To do so efficiently, according to the present invention, each data parcel is
16 independently processable by the client system, which is enabled by the selection
17 and server-side processing used to prepare a parcel for transmission. In addition,
18 each data parcel is sized appropriate to fit within the level-1 cache, or equivalent,
19 of the client system processor, thereby enable the data processing intensive
20 operations needed to process the data parcel to be performed without extended
21 memory access delays. In the preferred embodiment of the present invention,
22 data parcels are also processed for texture mapping and other image features,
23 such as topographical detailing.

24 Currently, with regard to conventional client systems, a larger image array,
25 such as 128x128, is too large to be fully placed within the level-1 cache of many

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