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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

REQUEST FOR FILING A PROVISIONAL APPLICATION FOR PATENT

UNDER 37 CFR §1.53 (c)

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INVENTOR(S)

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TITLE OF THE INVENTION

OPTIMIZATION OF IMAGE PARCEL DOWNLOAD SEQUENCE FOR FAST QUALITY BUILD-UP OF IMAGE DATA STREAMED OVER LIMITED AND NARROWBAND COMMUNICATION CHANNELS WITH DIFFERENT VIEWING FRUSTUM FROM A DYNAMIC THREE-DIMENSIONAL VIEWPOINT

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ENCLOSED APPLICATION PARTS *(check all that apply)*

X	Specification	No. of pages: 10		Small Entity Statement
X	Drawings	No. of sheets: 5		Power of Attorney
	Declaration			Assignment and Cover Sheet
X	Other: Return-Receipt Post Card.			

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT

Provisional Basic Filing Fee: $ 150.00 (Small Entity: $75.00) Filing Fee Amount: $ 150.00

X A check is enclosed to cover the Filing Fees.

X The Commissioner is hereby authorized charge Filing Fees or credit any overpayment to: Deposit Account Number: 50-0890.

X This invention was not made by or under contract with a US Government agency.

___ US Government agency and Contract: ___

Signature: Gerald B Rosenberg Date: December 26, 2000

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OPTIMIZATION OF IMAGE PARCEL DOWNLOAD SEQUENCE FOR FAST QUALITY BUILD-UP OF IMAGE DATA STREAMED OVER LIMITED AND NARROWBAND COMMUNICATION CHANNELS WITH DIFFERENT VIEWING FRUSTUM FROM A DYNAMIC THREE-DIMENSIONAL VIEWPOINT

Inventors:
Isaac Levanon
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Background of the Invention

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

Summary of the Invention

The objective is to display a two-dimensional pixel map, a16-Bit RGB color image in the preferred embodiments, of very large dimensions and permitting the viewing of the image from a dynamic three-dimensional viewpoint. Multiple such

images are remotely hosted for on-demand selection and transfer to a client system for viewing.

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

Description of the Invention

Overview:

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

The multiple layers of an image allow the selectivity to incorporate topographical, geographical, orientational, and other terrain and mapping related information into the image delivered. Other layers, such as geographic grids, graphical text overlays, and hyperlink selection areas, separately provided or composed, aid in the useful presentation and navigation of the image as presented by the client system and viewed by the user.

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

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

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

To optimize image quality build-up over limited and narrowband communication links, the target image, as requested by the client system, is represented by multiple grids of 64x64 image pixels (Figure 4) with each grid having some corresponding level of detail. That is, each grid is treated as a sparse data array that can be progressively revised to increase the resolution of the grid and thereby the level of detail presented by the grid. The reason for choosing the 64x64 pixel dimension is that, using current image compression algorithms, a 16-bit 64x64 pixel array image can be presented as a 2KByte data parcel. In turn, this 2KByte parcel is the optimal size, subject to conventional protocol and overhead requirements, to be transmitted through a 3KByte per second narrowband transmission channel. Using a smaller image array, such as 32x32, would create a 0.5KByte parcel, hence causing inefficiencies due to packet transmission overhead, given the nature of current wireless communications protocols.

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

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