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(54) METHOD AND APPARATUS FOR WIRELESS IMAGE TRANSMISSION TO A PROJECTOR

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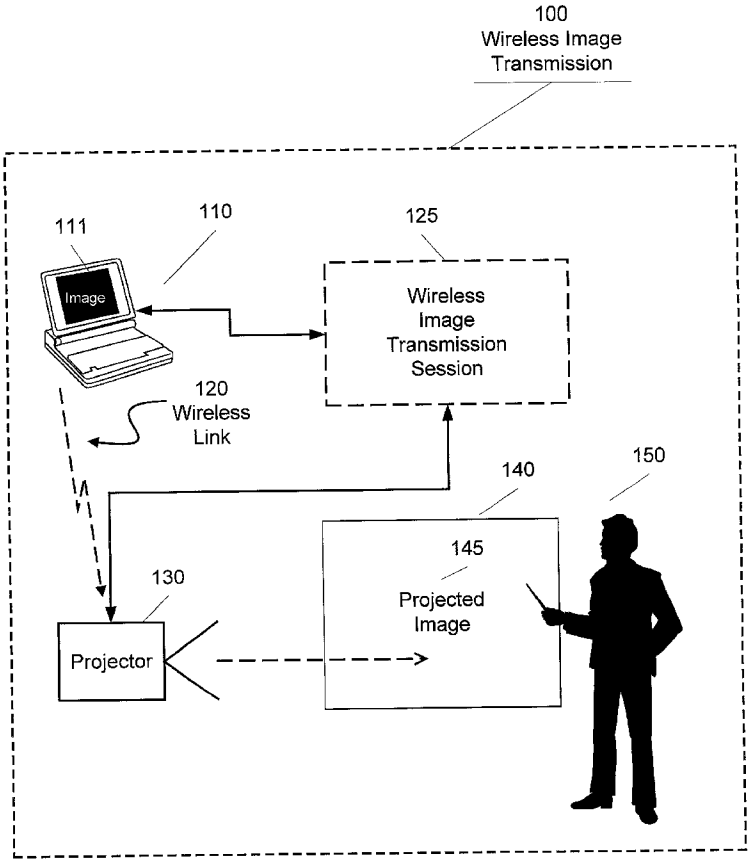
(57) **ABSTRACT**

A method and apparatus is provided in which a digital image is transmitted to a presentation projector resource over a wireless transmission medium using a reduced amount of transmission bandwidth by transmitting a subset of the digital image data. The subset image data may be a delta subset that represents those areas of the image that have changed since the previous transmission. The subset image data may also be a scalable vector graphics representation of the subset of the digital image. Header data is provided to further describe the subset image data. A projector discovery logic selects a suitable projector resource based on the order or signal strength of the discovery replies. A wireless image transmission session is established with the selected projector resource during which the projector is unavailable to other devices. The subset image data may be compressed and transmission coordinated with the projector resource so that the data is sent only when it is ready to be received. A wireless to digital visual interface (DVI) graphics engine decompresses and renders the image for output to a DVI connector receptacle. The rendered image is projected by the projector resource in accordance with the associated header data so that the exact image that appears on the image generation device also appears on the projected display.



YEALINK EX. 1033

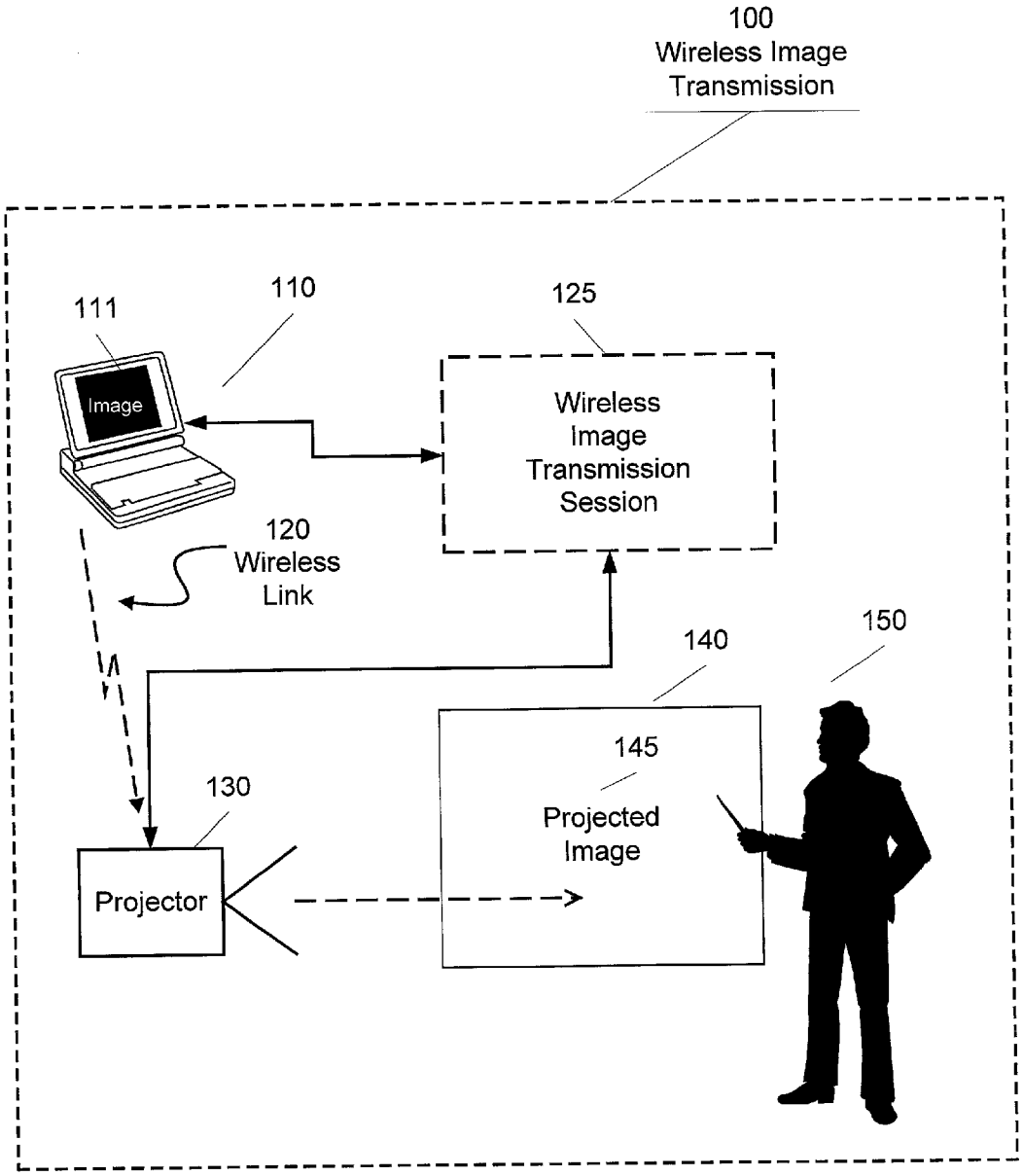

100
Wireless Image
Transmission
111
110
125
Image
Wireless
Image
Transmission
Session
120
Wireless
Link
140
150
145
130
Projected
Image
Projector

FIG. 1

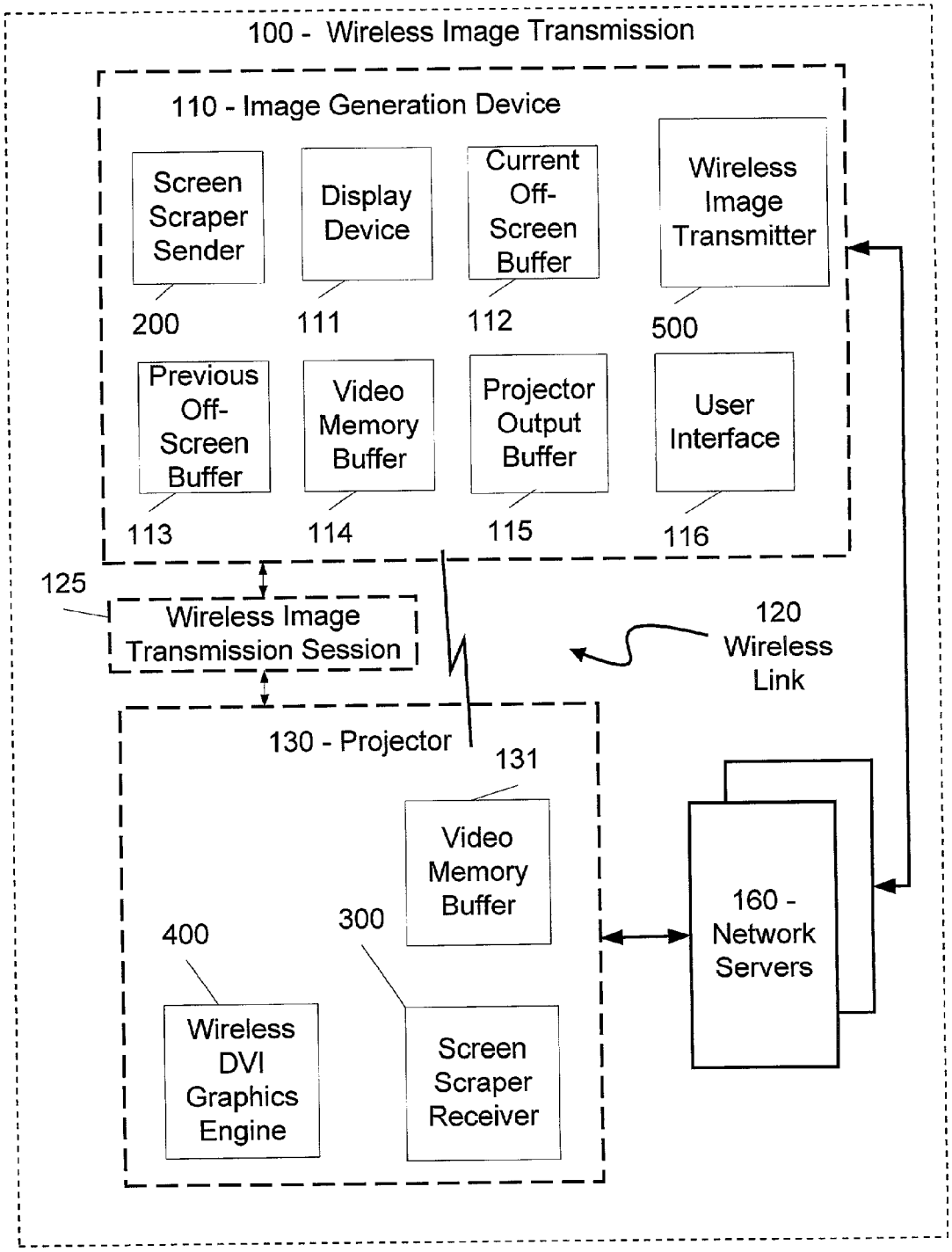

100 - Wireless Image Transmission
110 - Image Generation Device
Screen Scraper Sender
Display Device
Current Off-Screen Buffer
Wireless Image Transmitter
200
111
112
500
Previous Off-Screen Buffer
Video Memory Buffer
Projector Output Buffer
User Interface
113
114
115
116
125
Wireless Image Transmission Session
120 Wireless Link
130 - Projector
131
Video Memory Buffer
400
300
Wireless DVI Graphics Engine
Screen Scraper Receiver
160 - Network Servers

FIG. 2

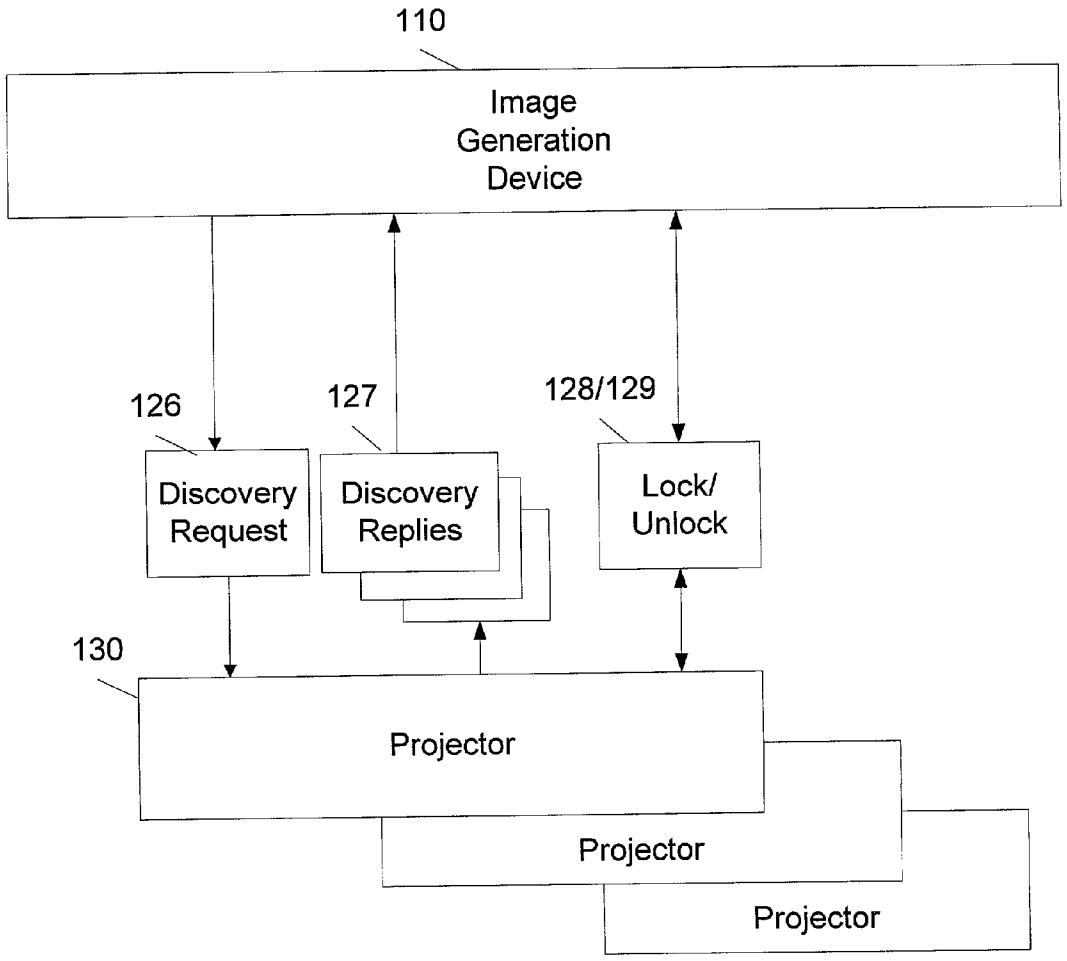

110
Image
Generation
Device
126
127
128/129
Discovery
Request
Discovery
Replies
Lock/
Unlock
130
Projector
Projector
Projector

FIG. 3

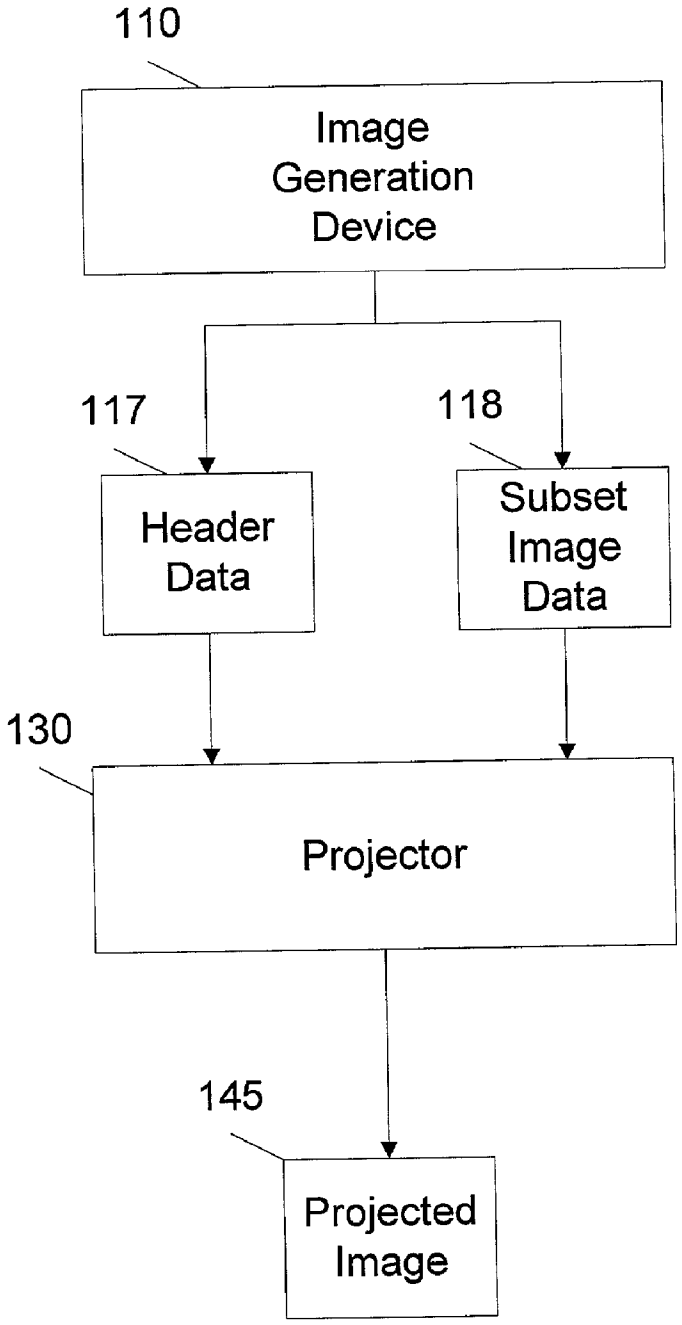

110
Image Generation Device
117
118
Header Data
Subset Image Data
130
Projector
145
Projected Image

FIG. 4

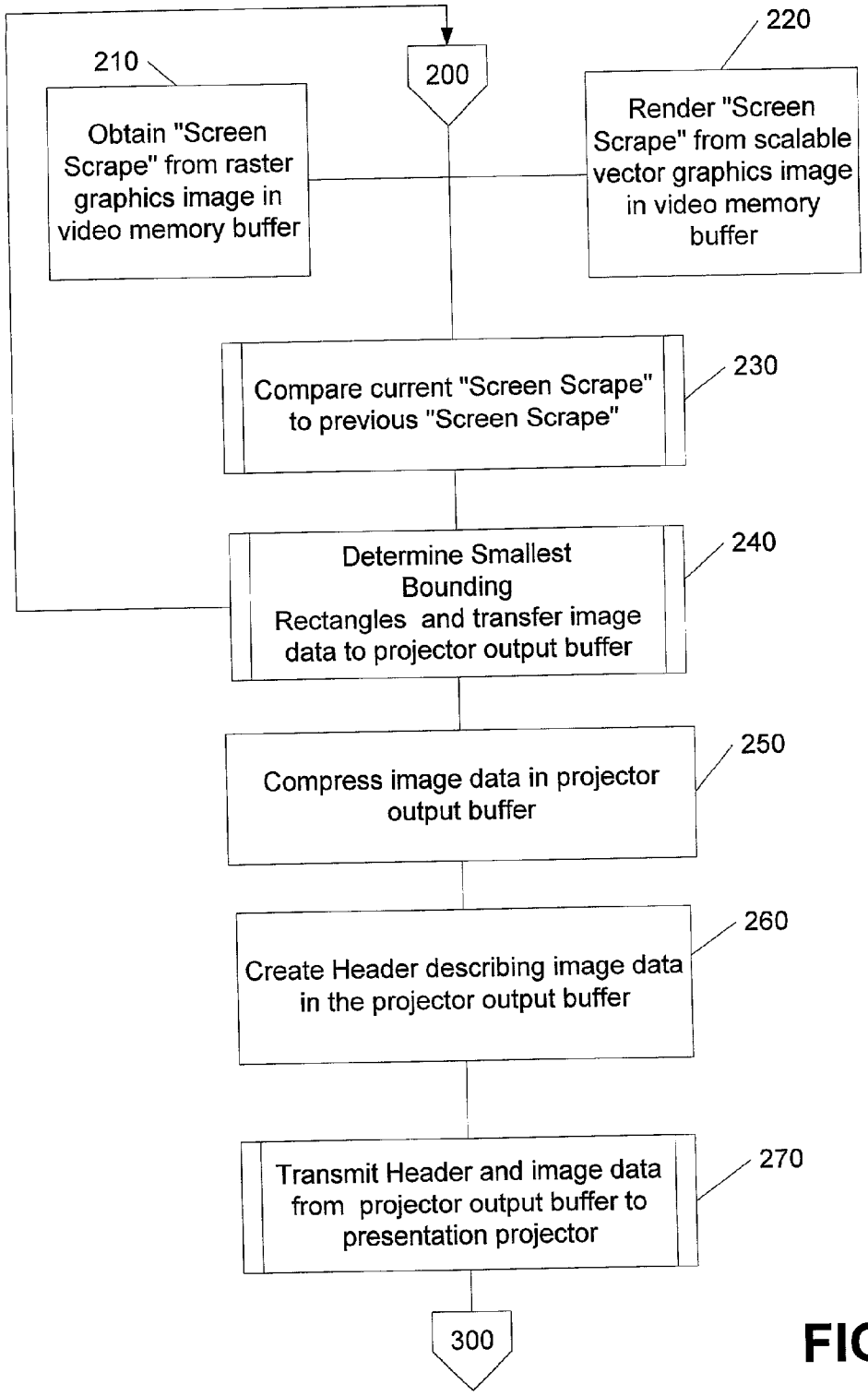

200
210
Obtain "Screen Scrape" from raster graphics image in video memory buffer
220
Render "Screen Scrape" from scalable vector graphics image in video memory buffer
Compare current "Screen Scrape" to previous "Screen Scrape"
230
Determine Smallest Bounding Rectangles and transfer image data to projector output buffer
240
Compress image data in projector output buffer
250
Create Header describing image data in the projector output buffer
260
Transmit Header and image data from projector output buffer to presentation projector
270
300

FIG. 5

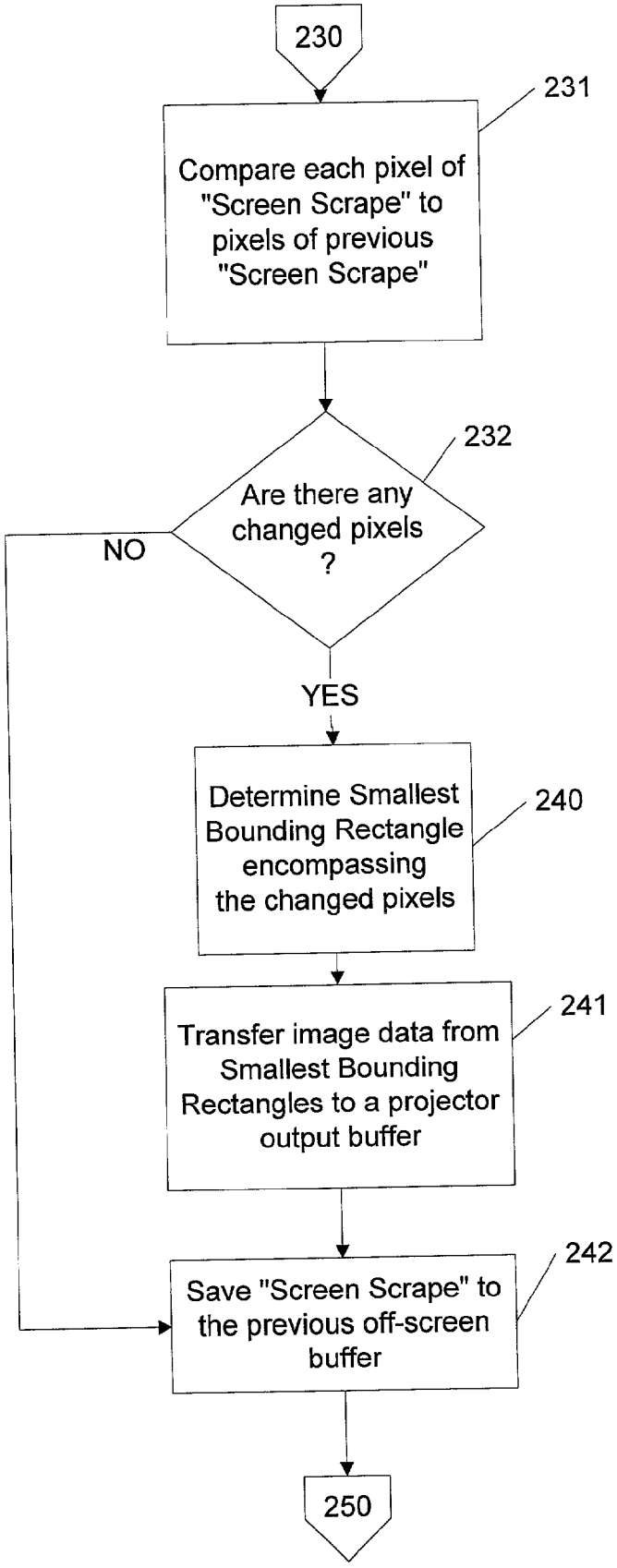

230
231
Compare each pixel of "Screen Scrape" to pixels of previous "Screen Scrape"
232
Are there any changed pixels ?
NO
YES
Determine Smallest Bounding Rectangle encompassing the changed pixels
240
Transfer image data from Smallest Bounding Rectangles to a projector output buffer
241
Save "Screen Scrape" to the previous off-screen buffer
242
250

FIG. 6

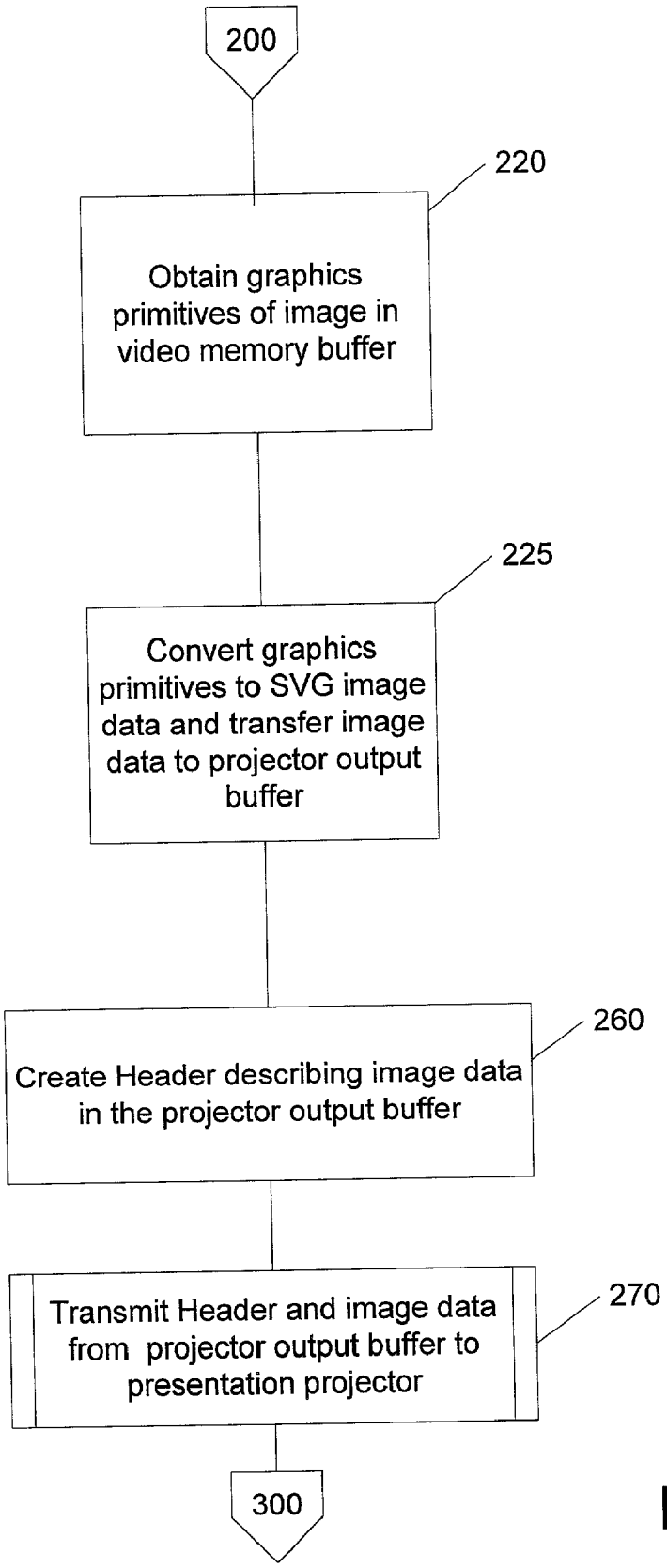

200
220
Obtain graphics primitives of image in video memory buffer
225
Convert graphics primitives to SVG image data and transfer image data to projector output buffer
260
Create Header describing image data in the projector output buffer
270
Transmit Header and image data from projector output buffer to presentation projector
300

FIG. 7

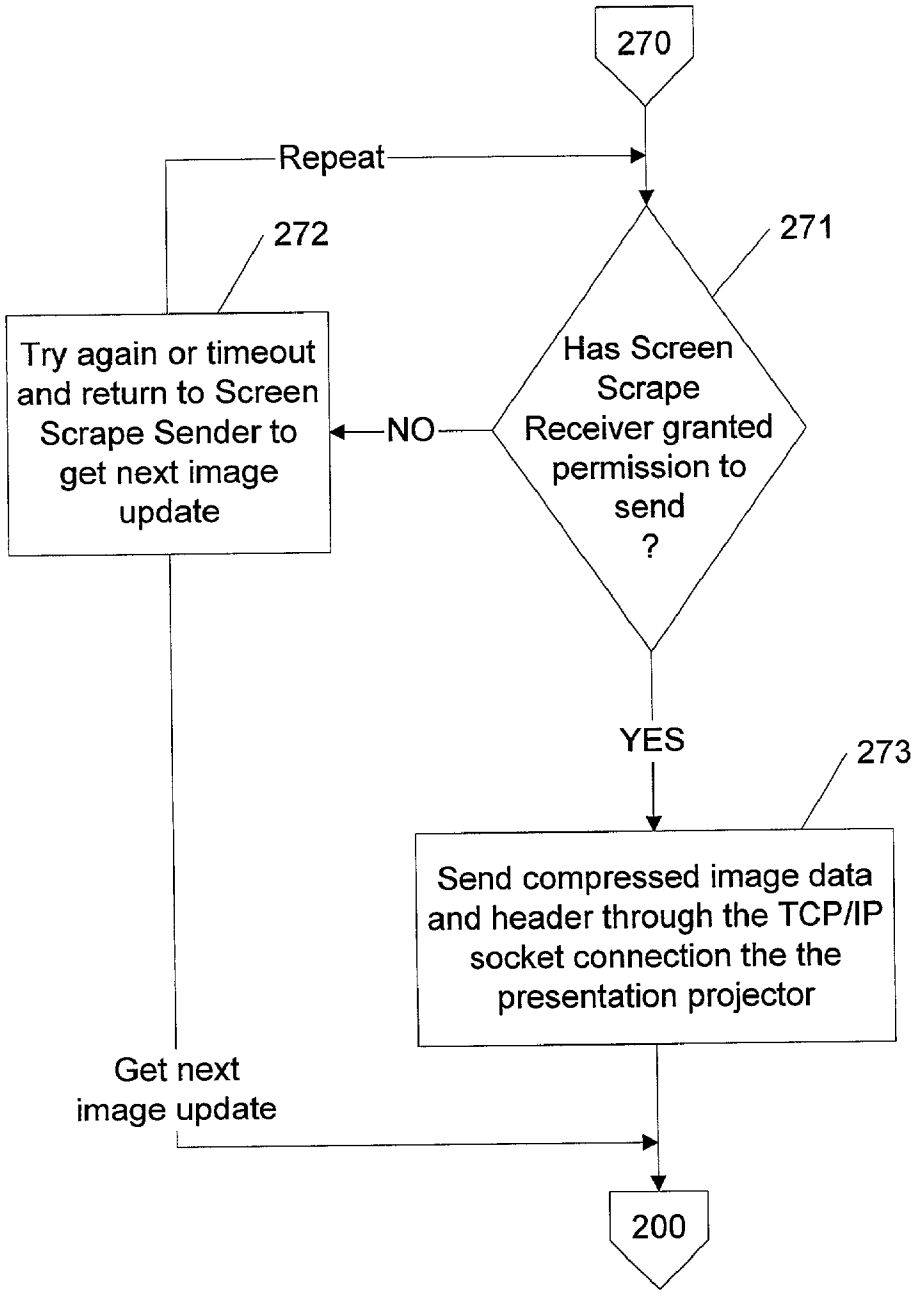

270
Repeat
272
271
Try again or timeout and return to Screen Scrape Sender to get next image update
NO
Has Screen Scrape Receiver granted permission to send ?
YES
273
Send compressed image data and header through the TCP/IP socket connection the the presentation projector
Get next image update
200

FIG. 8

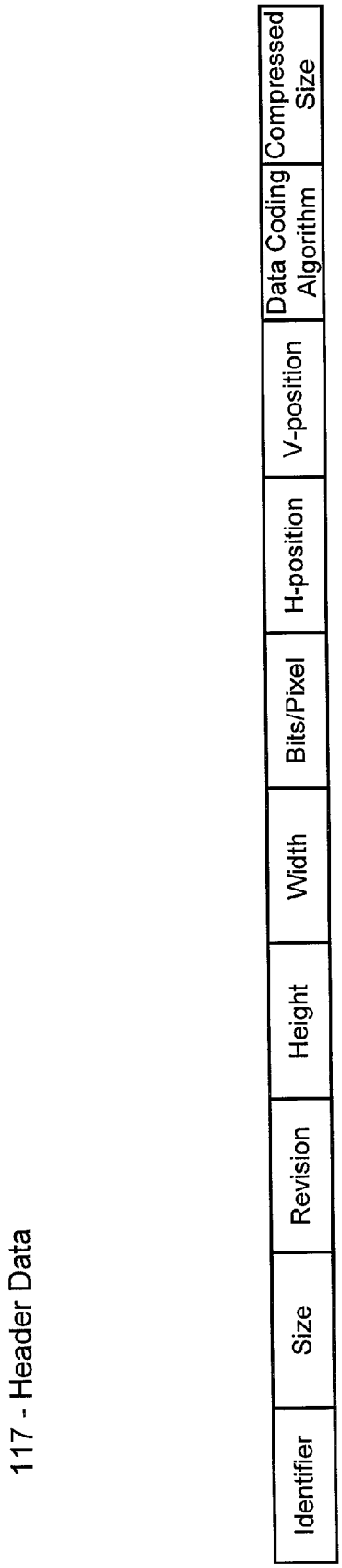

117 - Header Data
Identifier
Size
Revision
Height
Width
Bits/Pixel
H-position
V-position
Data Coding Algorithm
Compressed Size

FIG. 9

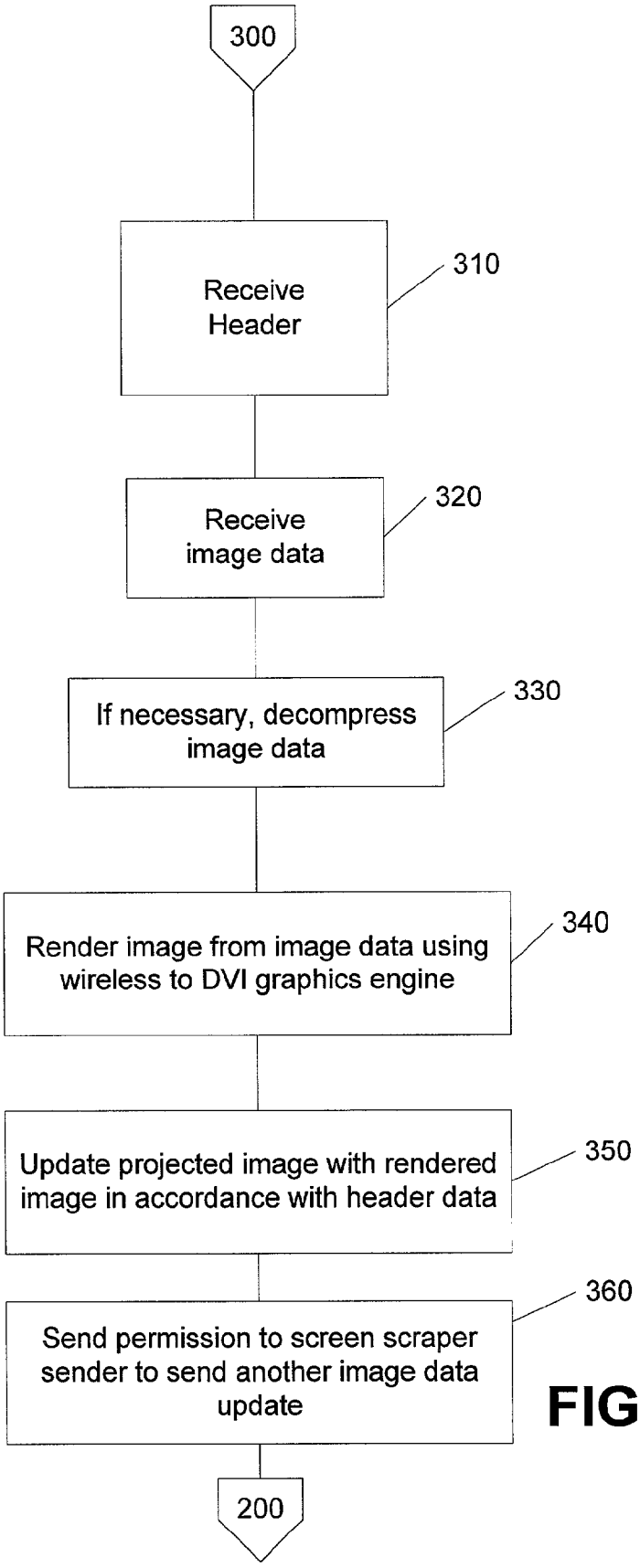

300
Receive Header
310
Receive image data
320
If necessary, decompress image data
330
Render image from image data using wireless to DVI graphics engine
340
Update projected image with rendered image in accordance with header data
350
Send permission to screen scraper sender to send another image data update
360
200

FIG. 10

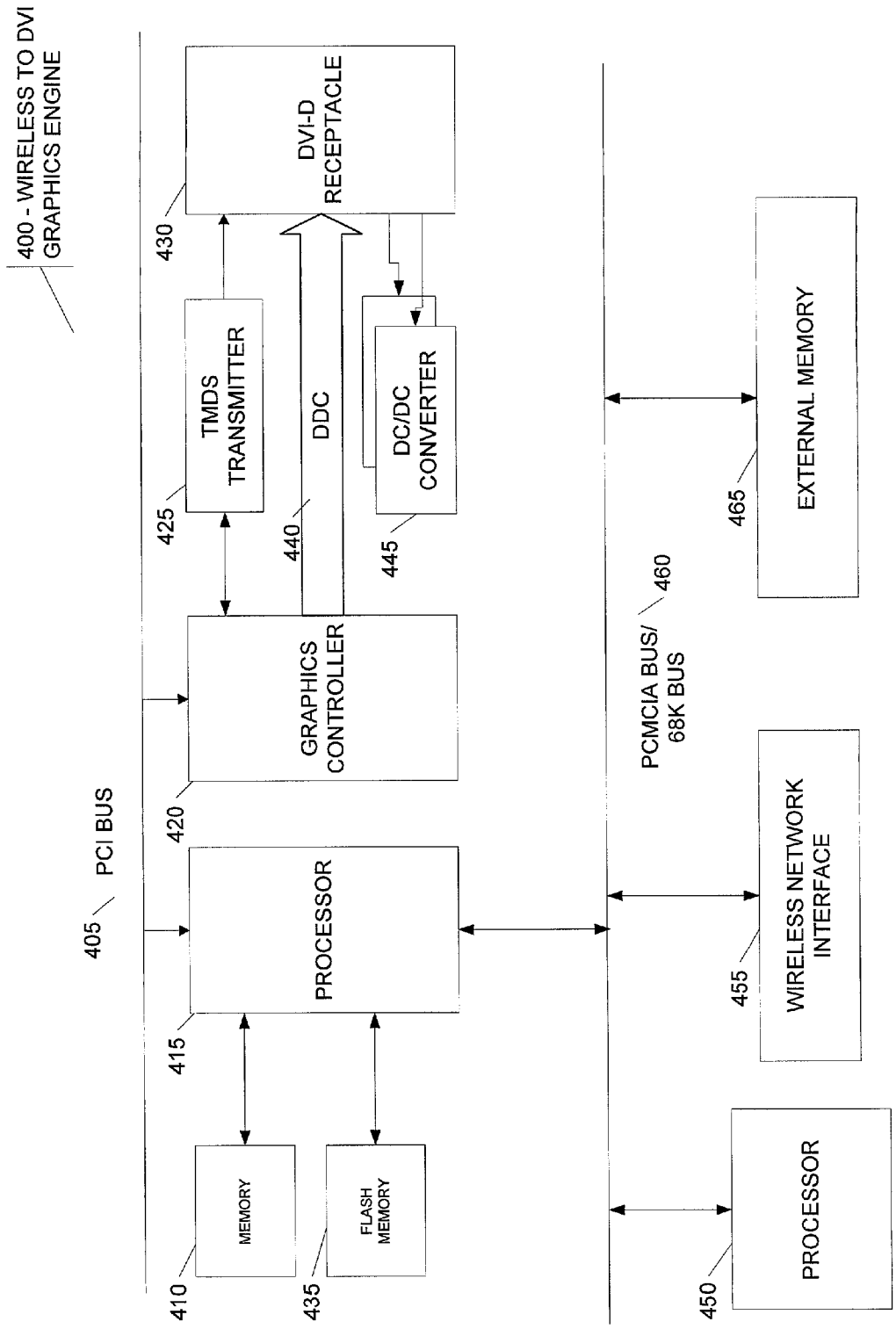

400 - WIRELESS TO DVI GRAPHICS ENGINE
PCI BUS
405
DVI-D RECEPTACLE
430
TMDS TRANSMITTER
425
DDC
440
DC/DC CONVERTER
445
GRAPHICS CONTROLLER
420
PROCESSOR
415
MEMORY
410
FLASH MEMORY
435
PCMCIA BUS/ 68K BUS
460
EXTERNAL MEMORY
465
WIRELESS NETWORK INTERFACE
455
PROCESSOR
450

FIG. 11

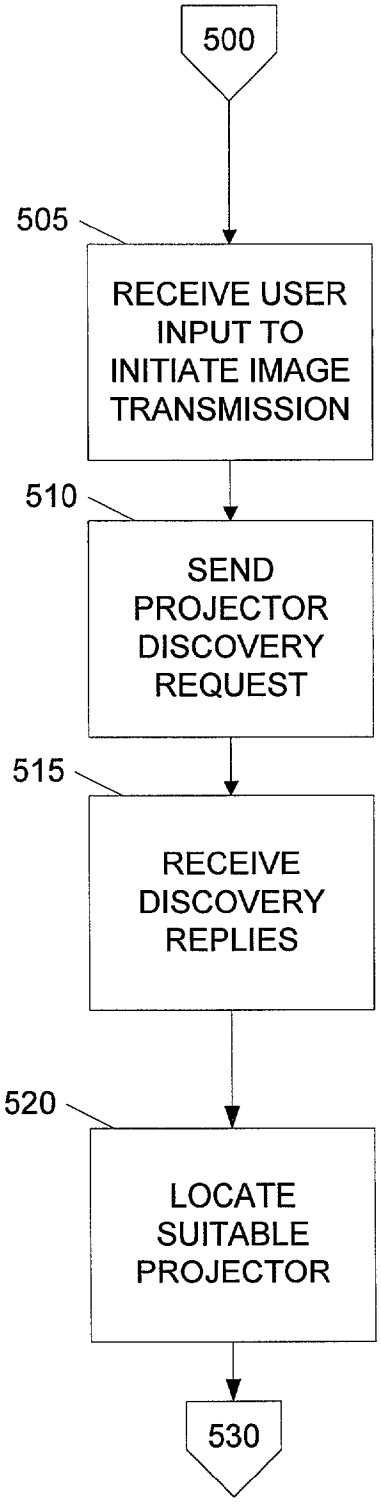

500
505
RECEIVE USER INPUT TO INITIATE IMAGE TRANSMISSION
510
SEND PROJECTOR DISCOVERY REQUEST
515
RECEIVE DISCOVERY REPLIES
520
LOCATE SUITABLE PROJECTOR
530

FIG. 12

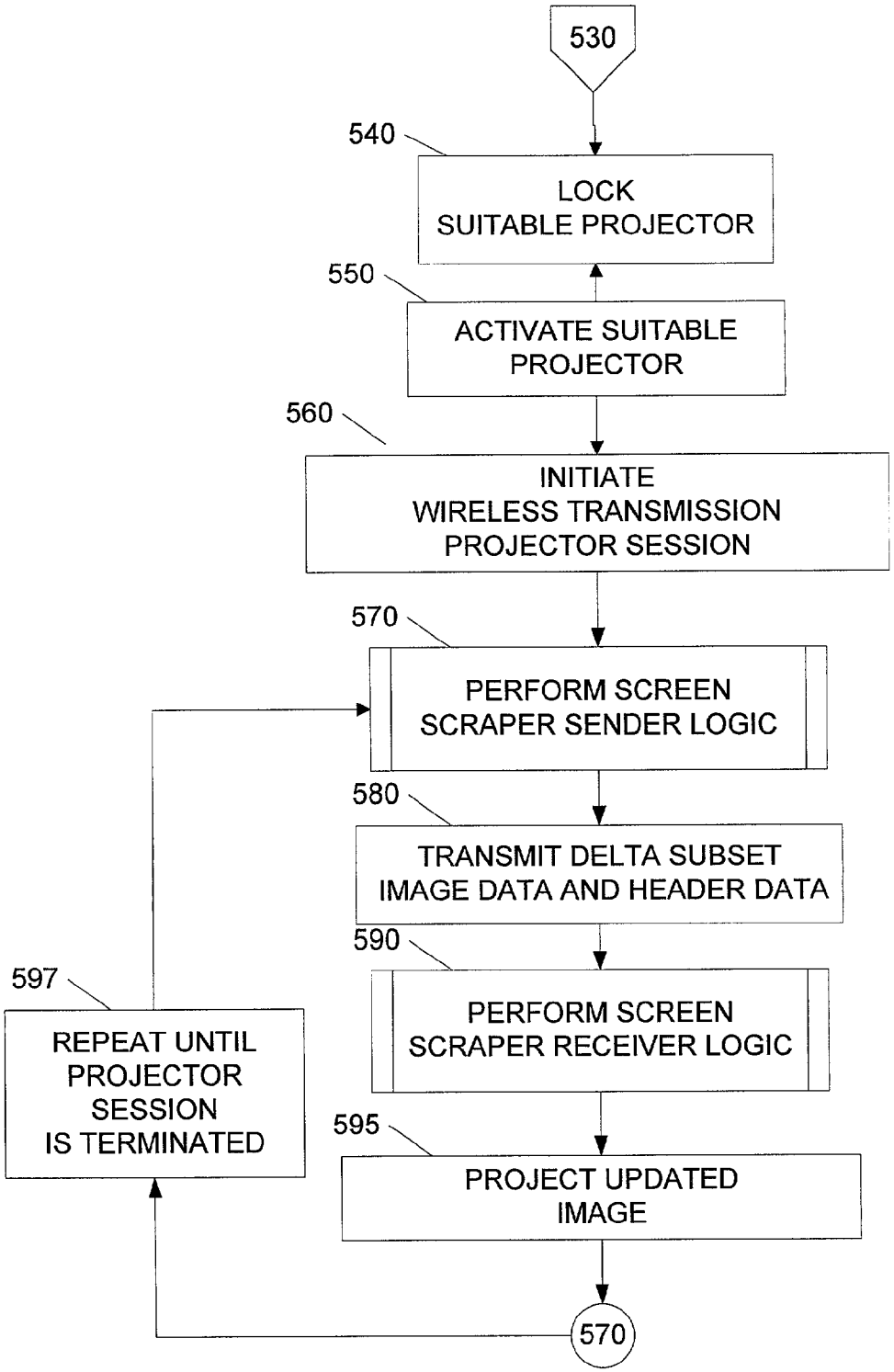

530
540
LOCK
SUITABLE PROJECTOR
550
ACTIVATE SUITABLE
PROJECTOR
560
INITIATE
WIRELESS TRANSMISSION
PROJECTOR SESSION
570
PERFORM SCREEN
SCRAPER SENDER LOGIC
580
TRANSMIT DELTA SUBSET
IMAGE DATA AND HEADER DATA
590
PERFORM SCREEN
SCRAPER RECEIVER LOGIC
595
PROJECT UPDATED
IMAGE
597
REPEAT UNTIL
PROJECTOR
SESSION
IS TERMINATED
570

FIG. 13

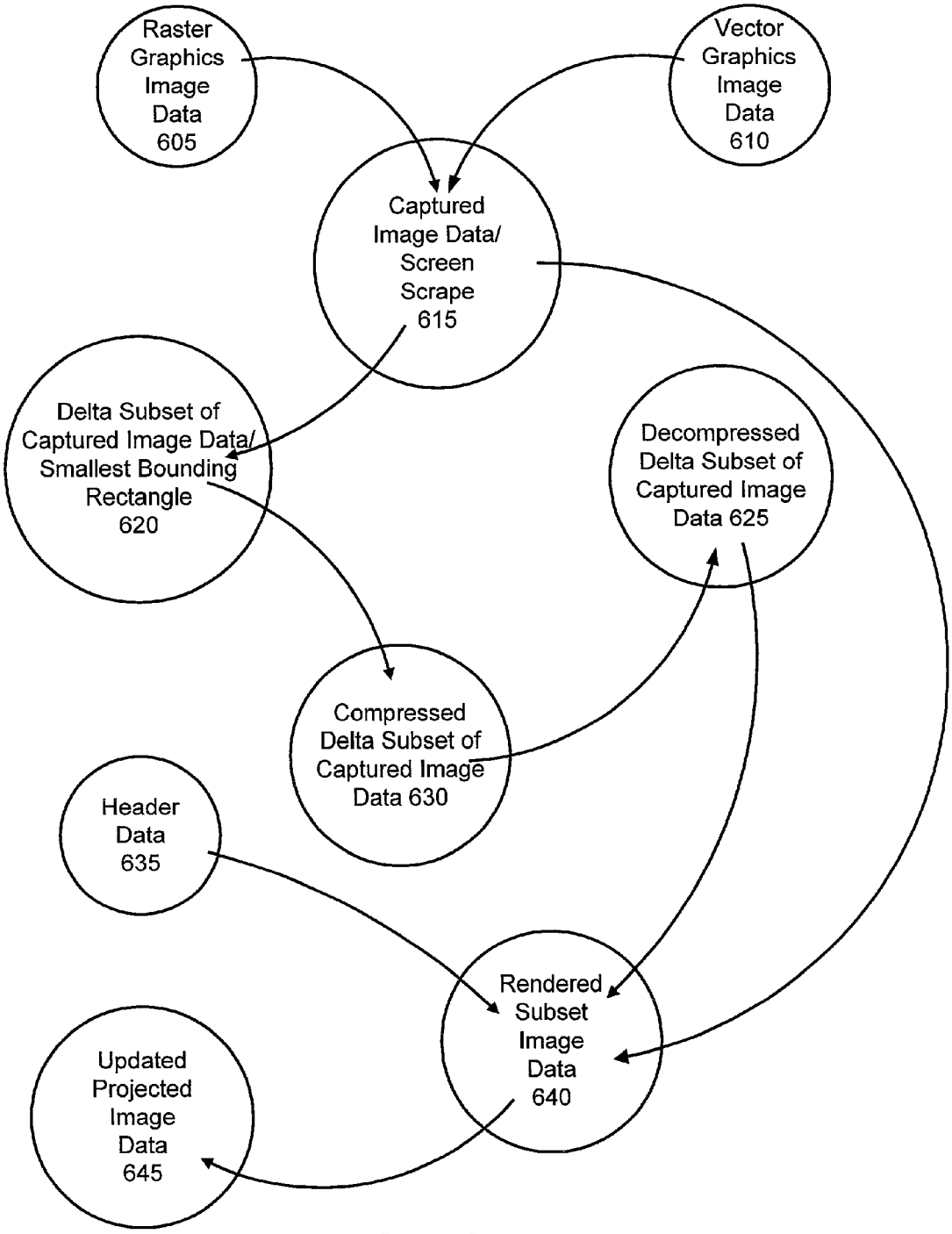

Raster Graphics Image Data 605
Vector Graphics Image Data 610
Captured Image Data/ Screen Scrape 615
Delta Subset of Captured Image Data/ Smallest Bounding Rectangle 620
Decompressed Delta Subset of Captured Image Data 625
Compressed Delta Subset of Captured Image Data 630
Header Data 635
Rendered Subset Image Data 640
Updated Projected Image Data 645

FIG. 14

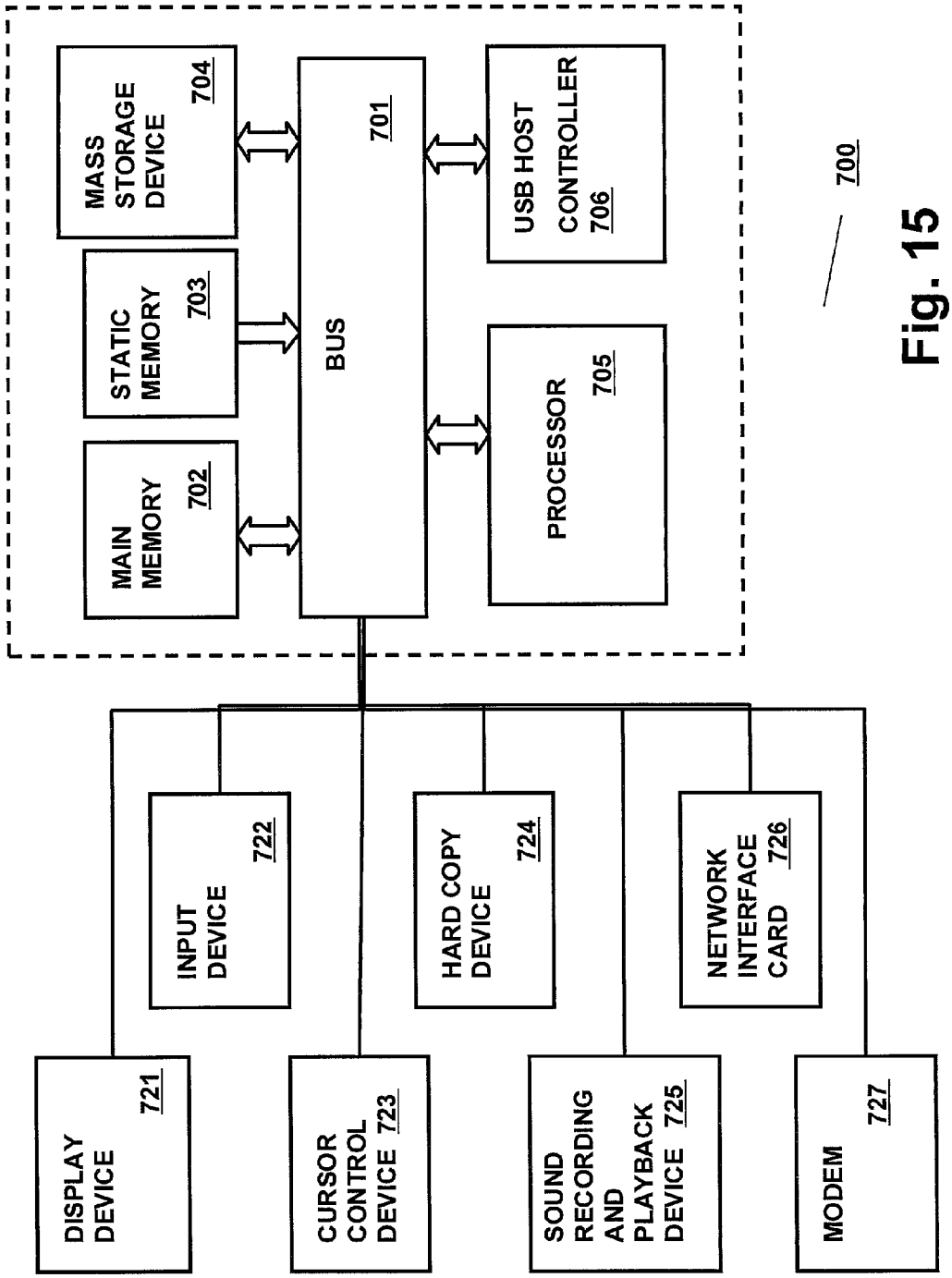

MASS STORAGE DEVICE 704
STATIC MEMORY 703
MAIN MEMORY 702
BUS 701
USB HOST CONTROLLER 706
PROCESSOR 705
700
INPUT DEVICE 722
HARD COPY DEVICE 724
NETWORK INTERFACE CARD 726
DISPLAY DEVICE 721
CURSOR CONTROL DEVICE 723
SOUND RECORDING AND PLAYBACK DEVICE 725
MODEM 727

Fig. 15

METHOD AND APPARATUS FOR WIRELESS IMAGE TRANSMISSION TO A PROJECTOR

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates generally to presentation projectors for projecting computer generated presentations and other images to a viewing surface. In particular, the present invention relates to technology that enables the wireless transmission of an image to a presentation projector.

[0003] 2. Background Information

[0004] The widespread acceptance of using computers to facilitate group communications has created a large demand for devices that project computer displays. As a result, corporate enterprises have installed multimedia projection systems in many workplace conference rooms, or provide access to portable presentation equipment that can be used in conference rooms as needed. In a typical operating mode, multimedia projection systems receive analog video signals from a personal computer ("PC"). The video signals may represent still, partial, or full-motion display images of a type rendered by the PC. The analog video signals are typically converted in the projection system into digital video signals, and the signals are electronically conditioned and processed to control an image-forming device, such as a liquid crystal display ("LCD") or a digital micro-mirror device ("DMD").

[0005] A popular type of multimedia projection system employs a broad-spectrum light source and optical path components upstream and downstream of the image-forming device to project the image onto a display screen. An example of a DMD-based multimedia projector is the model LP420 manufactured by InFocus Corporation., of Wilsonville, Oreg., the assignee of the present application.

[0006] To display their presentations, users tote portable computers such as laptops into the conference room, and attach the computer to the projector using a connecting cable. The necessity of carrying heavy cabling to attach the computer to the projector is inconvenient, especially when giving mobile presentations. Issues of cable compatibility or malfunction may occur and the set-up time is increased. Moreover, if more than one presenter uses the projection equipment, each with their own laptops, then each successive presenter needs to repeat the cabling set-up procedure, which results in a delay between presentations.

[0007] One way to eliminate the cabling problem is to transmit the image over a wireless communications link instead of a cable connection. Wireless transmission of an image to a projector is known in the art. For example, U.S. Pat. No. 5,847,748, Multimedia Projection System, which issued on Dec. 8, 1998, to David P. Laughlin, (the "'748 patent") discloses a multimedia projection system that includes a notebook computer that has an integral projector. The projector described in the 748 patent is capable of receiving information from the computer's central processing unit through a cable or a wireless communication circuit, including an infrared communication circuit.

[0008] An example of a prior art wireless presentation projector is the Notevision5 Liquid Crystal Display (LCD) projector manufactured by the Sharp Electronics Corporation of Mahwah, N.J. The Notevision5 LCD projector features an infrared communication capability, which allows users to transfer digital images from a laptop or a compatible device directly to the projector. The Sharp Notevision5 LCD projector relies on an Infrared Data Association (IrDA) data communication standard to transmit the image from the computer to the projector. One of the drawbacks to using the IrDA data communication standard is the bandwidth limitation inherent in infrared communications. Transmission data rates are low, with a maximum data transmission speed of up to 4 Mb/s (megabytes per second). This results in a very slow image update, typically up to at least 15 seconds per screen. The slow image update rate is unacceptable to most presentation system users.

[0009] In an effort to overcome the low data transmission rates, the IrDA data communication standards provide for converting and storing images in a compressed format in order to reduce the amount of data that is transmitted. The Sharp Notevision5 projector uses the Joint Photographic Experts Group (JPEG) image compression format, which is documented by the International Organization for Standards (ISO) in ISO standard 10918, *Information technology—Digital compression and coding of continuous-tone still images*, first published in 1994. However, the conversion and storage of the image using the JPEG image compression format is a process that is computationally intensive and necessarily delays the transmission of the image from the computer to the projector. Moreover, the size of the compressed JPEG images of a typical presentation is still unacceptably large, which does not allow for satisfactory update rates for displaying a wireless projected image.

[0010] Yet another drawback inherent in the use of the IrDA data communication standard is that infrared communication is a short-range technology limited to about a 30-50 foot radius. In addition, infrared communication is highly directional because the infrared signals cannot penetrate solid objects. Thus, interference is common and the signals can even be affected by indoor lighting (e.g. the use of fluorescent lights) and air quality (e.g. the presence of dust or smoke).

[0011] What is needed, therefore, is an improved method of wireless image transmission between a computer and a projector. In particular, the wireless transmission of an image that is independent of the wireless transmission medium and that provides for faster updates of the projected image in an efficient and user-friendly way presents a unique set of challenges, requiring a new and novel solution.

SUMMARY

[0012] According to one aspect of the invention, a method is provided in which a digital image is transmitted to a presentation projector resource over a wireless transmission medium using a reduced amount of transmission bandwidth. The method transmits a subset of the digital image and header data that describes the subset of the digital image. The subset of the digital image may comprise one or more blocks of image data that represent the smallest bounding rectangle that encompasses those areas of the digital image that have changed since the previous transmission, referred to herein as delta image data. The smallest bounding rectangle encompassing the delta image data is determined

using a screen scraper sender logic that obtains the screen scrape from a raster graphics image in a video memory buffer Alternatively, the subset of the digital image may comprise graphic primitives which the screen scraper sender logic encodes in a scalable vector graphics (SVG) format, referred to herein as SVG image data. The screen scraper sender logic creates the header data to identify which type of subset of the digital image is being transmitted, as well as certain details about the transmitted image, including the image size, height, width, and position.

[**0013**] According to one aspect of the invention, the image transmission is initiated using a projector discovery logic which is activated in response to a single user action, to automatically discover and select suitable presentation projector resources that are available to receive the subset image data and header data over the wireless transmission medium. A wireless image transmission session is established with the selected presentation projector resource during which the selected presentation projector is unavailable to other devices. The screen scraper sender logic compresses the delta image data and coordinates transmission of the subset of the digital image data and header data with a screen scraper receiver logic on the presentation projector resource so that data is sent only when ready to be received.

[**0014**] According to one aspect of the invention, the presentation projector resource is further equipped with a wireless to digital visual interface (DVI) graphics engine to decompress and render the transmitted subset of the digital image data for output to a DVI connector receptacle on the presentation projector resource in accordance with the Digital Display Working Group's DVI specification. The screen scraper receiver logic further applies the rendered image to the projected image in accordance with the associated header data so that the exact image that appears on the image generation device also appears on the projected display.

[**0015**] In accordance with other aspects of the present invention, apparatus are provided for carrying out the above and other methods.

BRIEF DESCRIPTION OF DRAWINGS

[**0016**] The present invention will be described by way of exemplary embodiments, but not limitations, illustrated in the accompanying drawings in which like references denote similar elements, and in which:

[**0017**] **FIG. 1** illustrates an overview of the method and apparatus for wireless image transmission to a projector in accordance with one embodiment;

[**0018**] **FIG. 2** illustrates a block diagram of selected components of the method and apparatus for wireless image transmission to a projector illustrated in **FIG. 1**, in accordance with one embodiment;

[**0019**] **FIG. 3** illustrates a simplified block diagram overview of the initiation and administration of a wireless image transmission session illustrated in **FIG. 1**, in accordance with one embodiment;

[**0020**] **FIG. 4** illustrates a simplified block diagram overview of the transmission of data during the wireless image transmission session illustrated in **FIG. 1**, in accordance with one embodiment;

[**0021**] **FIG. 5** illustrates a flow diagram of the operation of the method and apparatus for wireless image transmission to a projector screen scraper sender logic illustrated in **FIG. 2** in accordance with one embodiment;

[**0022**] **FIG. 6** illustrates in further detail selected aspects of the screen scraper sender logic illustrated in **FIG. 2** in accordance with one embodiment;

[**0023**] **FIG. 7** illustrates in further detail selected aspects of the screen scraper sender logic illustrated in **FIG. 2** in accordance with one embodiment;

[**0024**] **FIG. 8** illustrates in further detail selected aspects of the screen scraper sender logic illustrated in **FIG. 2** in accordance with one embodiment;

[**0025**] **FIG. 9** illustrates a data layout of a header data in accordance with one embodiment;

[**0026**] **FIG. 10** illustrates a flow diagram of the operation of the method and apparatus for wireless image transmission to a projector screen scraper receiver logic illustrated in **FIG. 2** in accordance with one embodiment;

[**0027**] **FIG. 11** illustrates in further detail selected aspects of the wireless to DVI graphics engine illustrated in **FIG. 2** in accordance with one embodiment;

[**0028**] FIGS. **12-13** illustrate a flow diagram of the operation of the method and apparatus for wireless image transmission to a projector illustrated in FIGS. **1-4** in accordance with one embodiment;

[**0029**] **FIG. 14** illustrates a data flow diagram of the method and apparatus for wireless image transmission to a projector illustrated in FIGS. **1-4** in accordance with one embodiment; and

[**0030**] **FIG. 15** illustrates a general-purpose computer system upon which an embodiment of the wireless image transmission to a projector method and apparatus may be implemented.

DETAILED DESCRIPTION OF THE INVENTION

[**0031**] In the following description various aspects of the method and apparatus for wireless image transmission to a projector will be described. Specific details will be set forth in order to provide a thorough understanding of the present invention. However, it will be apparent to those skilled in the art that the present invention may be practiced with only some or all of the described aspects of the present invention, and with or without some or all of the specific details. In some instances, well-known features may be omitted or simplified in order not to obscure the present invention.

[**0032**] Various operations will be described as multiple discrete steps performed in turn in a manner that is most helpful in understanding the present invention. However, the order of description should not be construed as to imply that these operations are necessarily performed in the order they are presented, or even order dependent. Lastly, repeated usage of the phrase "in one embodiment" does not necessarily refer to the same embodiment, although it may.

[**0033**] **FIG. 1** illustrates an overview of the method and apparatus for wireless image transmission to a projector **100** in accordance with one embodiment. As illustrated, an

image-generating device **110** such as a laptop computer generates a digital image on a display device **111** that is transmitted over a wireless link **120** to a remote presentation projector **130** for projection **145** to a presentation display surface **140** by a presenter **150** during a wireless image transmission session **125** established between the image-generating device **110** and the remote presentation projector **130**.

[**0034**] In one embodiment, the image generation device **110** may be any desktop personal computer, laptop computer, personal digital assistant (PDA), or other type of computer appliance capable of running an operating system platform with a graphical user interface such as Microsoft's Windows 98, Windows 2000, and Windows CE platforms. The image generation device **110** generates a digital image for a display device **111** that may be an LCD screen as illustrated or any type of display monitor that is capable of displaying the image generated by the image generation device **110**. In one embodiment the display device **111** may be eliminated, in which case the presenter **150** would rely solely on the projected image **145** for display of the digital image. The image-generation device **110** establishes a wireless image transmission session **125** with a remote presentation projector **130** that is accessible over the wireless link **120**. During the wireless image transmission session 125, the image generation device **110** functions as a projector server host that serves the generated digital image data via the wireless link **120** to the presentation projector **130**.

[**0035**] In one embodiment, the wireless link **120** may be any wireless transmission medium for a wireless network environment, including wireless networks designed in accordance with the IEEE 802.11 Wireless LAN Standard, or the Draft Specification of Bluetooth: A Global Specification for Wireless Connectivity, promulgated by the Bluetooth Special Interest Group.

[**0036**] In one embodiment, the remote presentation projector **130** is network-enabled and accessible over wireless link **120** and typically operates using a real-time operating system (RTOS) such as Wind River VX Works or Microsoft's Windows CE. The presentation projector **130** is further capable of receiving digital image data using the Digital Visual Interface version 1.0 (DVI), published by the Digital Display Working Group on Apr. 2, 1999. The presentation projector **130** may be a liquid crystal display (LCD), digital mirror device (DMD), liquid crystal on silicon (LCOS) projector or the like that include a light source and transmissive or reflective projection optics to form and project display images on a display surface **140** in both rear and front display applications. Examples of such presentation projectors are sold under the trademark LIGHTPORT by InFocus Corporation of Wilsonville, Oreg., the assignee of the present application.

[**0037**] **FIG. 2** illustrates a block diagram of selected components of the method and apparatus for wireless image transmission to a projector illustrated in **FIG. 1**, in accordance with one embodiment. The wireless image transmission **100** comprises the image-generating device **110** that is capable of running a wireless image transmitter logic **500** and a screen scraper sender logic **200**. The wireless image transmitter logic **500** initiates and administers the wireless image transmission session **125** between the image generating device **110** and the presentation projector **130**. The screen scraper sender logic **200** captures and generates a subset of the digital image data that was generated by the image generating device **110** for display to the display device **111**, and prepares the subset of the digital image data for transmission over the wireless link **120** to a presentation projector **130**.

[**0038**] In one embodiment, the presentation projector **130** is capable of running a screen scraper receiver logic **300** as well as a wireless DVI graphics engine **400**, which together enable the presentation projector **130** to receive the subset of the digital image data from the screen scraper sender logic **200** of the image generating device **110** and to render a continuously updated image to the projector's video memory buffer **131** for display to the projector display **140** with a minimal delay, regardless of the wireless transmission medium of the wireless link **120**.

[**0039**] The screen scraper sender logic **200**, screen scraper receiver logic **300**, wireless to DVI graphics engine **400**, and wireless image transmitter logic **500**, operate together with other selected components of the image generation device **110** and projector **130**, including the display device **111**, a current off-screen buffer **112**, a previous off-screen buffer **113**, a image generator device video memory buffer **114**, a projector output buffer **115**, a user interface **116**, and a projector video memory buffer **131**, the manner of which operation is described in further detail in FIGS. **3-13**. In one embodiment the screen scraper sender logic **200**, the wireless transmitter logic **500**, or any of the other components of the image generation device **110** may reside externally to the image generation device **110** as, for example, in another network server computer **160** in communication with the image generation device **110**, or other computer device, including a storage medium that is machine-accessible. Similarly, although illustrated as part of the presentation projector **130**, in one embodiment the components of the screen scraper receiver logic **300** or the wireless to DVI graphics engine **400** may reside externally to the presentation projector **130**. For example, portions or all of those components may be resident in a network server computer **160** functioning as a projector server computer in communication with the presentation projector **130**.

[**0040**] **FIG. 3** illustrates a simplified block diagram overview of the initiation and administration of the wireless image transmission session **125** by the wireless image transmitter logic **500** of image generation device **110**. In response to a single user action via user interface **116** on the image generation device **110**, the wireless image transmitter logic **500** sends a discovery request **126** to all projectors **130** accessible over wireless link **120**. Those projectors that can respond to the request do so by returning a projector discovery reply **127**. Depending on certain characteristics of the discovery replies **127**, the wireless image transmitter logic **500** automatically determines which projectors **130** are most suitable. The wireless image transmitter logic **500** selects one of the suitable projectors, either automatically or in response to a further user selection on user interface **116**, and initiates the wireless image transmission session **125** by sending a lock command **128** to lock the selected projector **130** for exclusive use. Upon termination of the wireless image transmission session **125**, the wireless image transmitter logic **500** sends an unlock command **129** to release the projector **130** so that it is available for use by others.

[0041] **FIG. 4** illustrates a simplified block diagram overview of the transmission of data during the wireless image transmission session **125**. The screen scraper sender logic **200** of the image generation device **110** generates a subset of the image generated for the display device **111** and transmits to the selected projector **130**, not only the subset of the digital image data **118**, but also an associated header data **117**. The subset of the digital image data **118** may comprise a delta image data that represents those areas of the image generated by the image generation device **110** that have changed since the last transmission. Alternatively, the subset of the digital image data **118** may comprise an SVG formatted image data that represents certain graphics primitives of the image generated by the image generation device **110**. The associated header data **117** identifies the type of digital image data being transmitted as well as certain characteristics of the digital image data, including the size, height, width, and position of the image, and whether and which type of compression was used.

[0042] It should be noted that in FIGS. **5-8**, **10**, **12-13**, the particular methods of the invention are described in terms of computer software logic with reference to a series of flowcharts. The methods to be performed by a computer constitute computer programs made up of computer-executable instructions. Describing the methods by reference to a flowchart enables one skilled in the art to develop such programs including such instructions to carry out the methods on suitably configured computers (the processor of the computer executing the instructions from computer-readable media). The computer-executable instructions may be written in a computer programming language or may be embodied in firmware logic, or even application specific integrated circuits (ASICs). If written in a programming language conforming to a recognized standard, such instructions can be executed on a variety of hardware platforms and for interface to a variety of operating systems. In addition, the present invention is not described with reference to any particular programming language. It will be appreciated that a variety of programming languages may be used to implement the teachings of the invention as described herein. Furthermore, it is common in the art to speak of software, in one form or another (e.g., program, procedure, process, application, etc.), as taking an action or causing a result. Such expressions are merely a shorthand way of saying that execution of the software by a computer causes the processor of the computer to perform an action or a produce a result.

[0043] The invention may be described by reference to different high-level software logic modules such as computer program modules, and/or low-level hardware contexts. Those skilled in the art will realize that program module references can be interchanged with low-level hardware instructions. Program modules include procedures, functions, programs, components, data structures, and the like, that perform particular tasks or implement particular abstract data types. The modules may be incorporated into single and multi-processor computing systems, as well as hand-held devices and controllable consumer devices (e.g., Personal Digital Assistants (PDAs), cellular telephones, etc.). It is understood that modules may be implemented on a single computing device, or processed over a distributed network environment, where modules can be located in both local and remote memory storage devices.

[0044] **FIG. 5** illustrates in further detail selected functional components of the screen scraper sender logic **200** illustrated in **FIG. 2** in accordance with one embodiment. At block **210** the screen scraper sender logic **200** obtains a copy of the raster graphics image from the video memory buffer **114** in the image generation device **110**. The raster graphics image in the video memory buffer **114** is the binary data that represents the image on the image generation device's display device **111** (e.g. a computer monitor or a laptop LCD as illustrated in **FIG. 1**). The screen scraper sender logic **200** obtains the binary data by directly accessing the contents of the video memory buffer **114** using a display control interface such as, for example, the Microsoft Windows operating system's DirectDraw facility. The contents of the video memory buffer **114** are copied into the current off-screen buffer **112**, and are referred to as a "screen scrape."

[0045] At block **230**, the screen scrape sender logic compares the "screen scrape" in the current off-screen buffer **112** with the "screen scrape" that was previously saved in the previous off-screen buffer **113**. If there are no changes, then the screen scraper sender logic **200** repeats the processes in blocks **210**, **220**, and **230** until a change in the digital image occurs. If there are changes, then the screen scraper sender logic continues at block **240** to determine the smallest bounding rectangle that encompasses the changes in the digital image. Depending on the changes, there may be several bounding rectangles that encompass the changes in the image.

[0046] **FIG. 6** illustrates in further detail the screen scrape comparison at block **230** and the determination of the smallest bounding rectangle at block **240** of the screen scraper sender logic **200** illustrated in **FIG. 3** in accordance with one embodiment. At block **231**, the screen scraper sender logic compares each pixel of the screen scrape in the current off-screen buffer **112** to each corresponding pixel of the previous screen scrape in the previous off-screen buffer **113**. At block **232**, the screen scraper sender logic **200** determines whether there are any changed pixels. If there are changed pixels at block **232**-YES branch, then processing continues at block **240** to determine the smallest bounding rectangle that encompasses those pixels of the screen scrape in the current off-screen buffer **112** that have changed since the previous screen scrape in the previous off-screen buffer **113** was obtained. It should be noted that, in one embodiment, each pixel may be comprised of digital image data for each of the color, shades of gray, and/or intensity components that represent the optical state of the pixel. In determining whether the pixel value has changed, any one or all of these color, grayscale, or intensity components may be compared.

[0047] At block **241**, processing continues to transfer the pixels encompassed by the smallest bounding rectangle, i.e. the delta image data, to the projector output buffer **115** in preparation for transmission over the wireless link **120** to the presentation projector **130**. The delta image data in the projector output buffer **115** is the subset image data **118** which is transmitted to the projector **130**. When received by the screen scraper receiver logic **300**, this delta image data will be used to update the projected image **145** using the wireless DVI graphics engine **400**.

[0048] Returning now to **FIG. 5**, processing continues at block **250** where the screen scraper sender logic **200** com-

presses the subset image data **118** in the projector output buffer **115** in further preparation for transmission over the wireless link **120** to the presentation projector **130**. In one embodiment, the compression is performed using a standard compression technique such as the LZO compression method of Franz Xavier Johannes Oberhumer. However, other compression techniques that provide lossless (or acceptably lossy) and efficient compression may be employed without departing from the principles of the present invention.

[**0049**] **FIG. 7** illustrates in further detail selected functional components of the screen scraper sender logic **200** illustrated in **FIG. 2** in accordance with an alternate embodiment. Instead of using a raster graphics image as described in detail in **FIGS. 5 and 6**, **FIG. 7** illustrates the use of scalable vector graphics (SVG) images. An SVG image is a description of a digital image using mathematical equations called vector graphics, instead of the bit-pattern description of the image itself as used in raster graphics images. One advantage to using vector graphics is that the image can easily be made scalable, whereas an image specified in raster graphics is a fixed-size bitmap. In one embodiment, at block **220**, the "screen scrape" is rendered into the current off-screen buffer **112** by first obtaining the operating system dependent graphics primitives that comprise the image from the video memory buffer **114** instead of the raster graphics image. At block **225**, the screen scraper sender **200** converts the graphics primitives to an SVG image data and transfers the SVG image data to the projector output buffer **115** in preparation for transmission over the wireless link **120** to the presentation projector **130**. The SVG image data in the projector output buffer **115** is the subset image data **118** which is transmitted to the projector **130**. When received by the screen scraper receiver logic **300**, this SVG image data will be used to update the projected image **145** using the wireless DVI graphics engine **400**.

[**0050**] The SVG description of the image may be implemented as an application of the Extensible Markup Language (XML), but other types of vector graphic descriptions may be employed without departing from the principles of the present invention. When SVG is used to describe the image, then the delta image data determination and special image compression described in FIGS. **5-6** would not be used. Rather, the SVG image data itself represents a highly compressed image representation. Thus determination of a delta image data and additional compression would not be needed.

[**0051**] Returning again to **FIG. 5**, at block **260**, the screen scraper sender logic **200** creates a header data **117** that contains data describing the subset image data **118** in the projector output buffer **115**. In one embodiment, the data fields that comprise the header data **117** are illustrated in **FIG. 9**. As shown, the header data **117** is comprised of numerous data fields that are described in further detail below in Table 1.

TABLE 1

Identifier	A value that identifies which type of subset image data 118 is being transmitted
Size	A value that represents the size of the image represented by the subset image data 118

TABLE 1-continued

Revision number	A number that indicates which revision of the image is being transmitted since the initiation of the wireless image transmission session 125.
Image height	The height of the image represented in the subset image data 118
Image width	The width of the image represented in the subset image data 118
Bits per pixel	The number of bits per pixel of the image represented in the subset image data 118
Horizontal position (x-coordinate)	The horizontal position of the image represented in the subset image data 118
Vertical position (y-coordinate)	The vertical position of the image represented in the subset image data 118
Data Coding Algorithm	A value indicating which algorithm has been used to encode or compress the subset image data 118, e.g. in the case of SVG image data, the SVG encoding algorithm (XML, etc.), or in the case of delta image data, the compression encoding algorithm (GIF, JPEG, LZO, etc.).
Compressed Size	A value that represents the size of the subset image data 118 after compression or encoding.

[**0052**] In one embodiment, the header data **117** and subset image data **118** may be sent as a single packet of data across the wireless link **120**. Upon receiving the single packet of data, the projector **130** parses the packet into header data **117** and subset image data **118**.

[**0053**] Returning again to **FIG. 5**, the screen scrape sender logic **200** continues at block **270** by initiating the transmission of the header data **117** and the subset image data **118** from the output buffer **115** of the image generating device **110** to the input video memory buffer **131** of the presentation projector **130**. **FIG. 8** illustrates in further detail, at block **270**, the screen scrape transmission portion of the screen scrape sender logic **200** illustrated in **FIG. 3** in accordance with one embodiment. At block **271**, the screen scrape sender logic **200** determines whether the screen scrape receiver **300** has granted permission to send the subset image data **118**. The permission may be communicated using any proprietary or standardized mechanism that is capable of negotiating permission between the image generator device **110** and the projector **130**. For example, a Universal Plug and Play method could be used to communication permission. If permission has not been granted, then at block **272**, the screen scraper sender logic **200** returns to block **271** to try again until succeeding in either sending the subset image data **118** or timing out. If there is a time out, then the screen scraper sender logic **200** returns to the beginning at block **200** to start the screen scrape process over again.

[**0054**] In one embodiment, if the screen scrape receiver **300** grants permission to the screen scrape sender to send the subset image data **118**, then the header data **117** and the subset image data **118** from the output buffer **115** of the image generation device **110** are sent over the wireless link **120** through a Transmission Control Protocol/Internet Protocol (TCP/IP) socket connection to the presentation projector **130**. Other types of transport protocols other than TCP/IP that guarantee delivery so that no data is lost through the connection may also be used to transmit the header and delta subset image data without departing from the principles of the present invention.

[0055] The entire process embodied in the screen scraper sender logic **200** is repeated continually throughout the duration of the wireless image transmission **100**, until the transmission is terminated by a user input by the presenter **150** through the user interface **116** of the image generation device **110** or by some other terminating event, such as a network or power failure. The end result is that the amount of image data transmitted over the wireless communication link **120** during the wireless image transmission session **125** is significantly reduced since the screen scraper sender logic **200** only sends the a subset image data **118** that represents either a delta image data or an SVG-encoded image data of the digital image data captured by the screen scraper sender logic **200**.

[0056] **FIG. 10** illustrates in further detail selected components of the screen scraper receive logic **300** illustrated in **FIG. 2** in accordance with one embodiment. At blocks **310/320** the screen scraper receive logic **300** receives the header data **117** and subset image data **118**. In the case where a delta image data has been transmitted, at block **330**, the screen scraper receiver logic **300** decompresses the subset image data **118** in accordance with the header data **117** data fields that describe the subset image data **118**, including the type of data coding algorithm used to compress the data. Using the wireless to DVI graphics engine **400**, at block **340** the screen scraper receiver logic **300** initiates the rendering of the subset image data **118**. The wireless to DVI graphics engine **400** is described in detail in **FIG. 11** below. At block **350**, the screen scraper receiver logic **300** updates the projected image **145** displayed by the projector **140** with the rendered subset image in accordance with the image description in the data fields of the header data **117**. For example, by using the corresponding values in header data **117** data fields, image height, width, horizontal position and vertical position, the screen scraper receiver logic **300** can substitute, in the proper location, the pixels in the previous projected image with the pixels rendered from the subset image data **118**. Other techniques for updating the projected image **145** with the rendered subset image data **118** may be employed without departing from the principles of the present invention. Finally, at block **360**, the screen scraper receiver logic **300** grants permission to the screen scraper sender logic **200** to send another subset image data **118** of the next image captured by the screen scraper. Upon successful completion of each transmission, the screen scraper sender logic **200** returns to the beginning at block **210/220** to repeat the screen scrape sender and receiver processes **200/300** until the wireless image transmission to projector session **125** is terminated.

[0057] **FIG. 11** illustrates in further detail selected components of the wireless to DVI graphics engine **400** illustrated in **FIG. 2** in accordance with one embodiment. The wireless to DVI graphics engine **400** may be incorporated into the presentation projector **130** itself or in an external computing device, such as a network server **160** or other computing device, connected to the presentation projector **130**. As shown, wireless to DVI graphics engine **400** comprises a PCI (peripheral component interconnect) bus **405**, a PCMCIA (Personal Computer Memory Card International Association) bus or a 68K bus **460**, or other communications hardware and software for communicating information, a processor **415** coupled with buses **405/460** for processing information, a graphics controller **420** coupled to the PCI bus **405**. Wireless to DVI graphics engine **400** further comprises a main memory or other dynamic storage device **410** and a non-volatile flash memory **435** coupled to processor **415** for storing information and instructions to be executed by processor **415**. Wireless to DVI graphics engine **400** may also comprise processor **450** and an external memory **465**, coupled to bus **460**, for storing and processing information and instructions. Graphics controller **420** is coupled to DVI-D receptacle **430** via a Display Data Channel (DDC) **440**. The DVI-D receptacle **430** is equipped with a transmission minimized differential signaling (TMDS) link **425**, which is used to transmit the graphics data to the projector display in accordance with the DVI standard. The DVI-D receptacle **430** is further connected to one or more Direct Current (DC) converters. A wireless network interface **455** is coupled to PCMCIA or 68K bus to receive the subset image data **118** and header data **117** from the image generation device **110**.

[0058] In operation, the processor **415** decompresses the delta subset image data **118** that was received via wireless network interface **455**, when necessary and in accordance with the header data **117** data fields, and sends the decompressed image data to the graphics controller **420**. The graphics controller **420** receives the decompressed image data or the subset image data **118** directly and stores it in a frame buffer in memory **410**. Subsequently, the graphics controller **420** retrieves the image data from the frame buffer in memory **410** and sends the image data to the TMDS transmitter **425** which, in turn, outputs DVI-formatted image data for input to the DVI-D receptacle **430** connected to the presentation projector display **130**.

[0059] FIGS. **12-13** illustrate a flow diagram of the operation of the wireless image transmitter **500** illustrated in **FIG. 1** in accordance with one embodiment. At block **505** the operation of the wireless image transmitter **500** begins with receiving a user input via user interface **116** of image generation device **110** to initiate an image transmission. The user input is typically entered on the image generation device **110** using an input device connected to the image generation device **110**, either alone or in combination with a display graphical user interface **116** to indicate the user's desire to initiate the wireless image transmission session **125**. However, it should be understood that other techniques for receiving the user input may be employed without departing from the principles of the present invention. In one embodiment, the user input comprises a single action taken by the user to initiate the wireless image transmission session **125**.

[0060] At block **510**, the wireless image transmitter **500** sends a projector discovery request **126** over the wireless link **120** in response to the user input entered at block **505**. At block **515**, the wireless image transmitter **500** receives projector discovery replies **127** from receivers (projectors) within radio frequency range of the image generation device **110**. At block **520**, the wireless image transmitter **500** automatically selects a suitable presentation projector **130** based on characteristics of the signal, such as the signal strength of the projector discovery replies or the signal's time displacement. In one embodiment, the identity of the projectors discovered would be displayed on the user interface **116** of the image generating device **110** and the presenter **150** would manually select the receiver projector **130** with which to initiate the wireless image transmission session **125**. For example, the discovered projectors might be

represented on the user interface **116** by various projector icons or other visual graphics symbols, and the user/presenter **150** would click on the desired projector icon to select the corresponding projector.

[**0061**] In one embodiment, the automatic selection of the projector may based on the characteristic of the elapsed time between sending of the discovery request **126** and the return of the discovery reply **127**, provided that the signal processing time at the projector **130** does not introduce unwanted variability from projector to projector. Since the speed of light is **108** meters/second, there is an inherent (one-way) signal delay of 10 nanoseconds per meter of distance between image generation device **110** and the projector **130**. The time it takes for the signal to go between the projector and image generation device need not be accurately measured, rather it is the order that the discovery replies **127** are received from the various projectors within discoverable range that is important. So projector-to-projector processing time variability should not exceed tens of nanoseconds for proper determination of the most suitable projector. In one embodiment, the automatic selection of the projector may be further based on the characteristic of the relative signal strength of the discovery replies **127**, with the strongest signal indicating which of the responding projectors is most suitable. In one embodiment a combination of the order and signal strength of the discovery replies **127** are used to select the most suitable projector.

[**0062**] Turning now to **FIG. 13**, once a suitable presentation projector **130** is selected, at block **540** the wireless image transmitter **500** locks the suitable projector so that no other requester can use it using a projector lock-out process. In the projector lock-out process at block **540**, the state of the projector **130** can be either "locked" or "unlocked". For example, the projector **130** is in a locked state if a wireless image transmission session **125** is already in progress or the projector is on and receiving images from one of its wired sources. When the wireless image transmitter **500** sends a query to the destination projector **130**, a "locked" or "unlocked" state reply is returned. If the projector **130** is locked, a "projector is busy" message is displayed on the user interface **116** of the image generation device **110**.. If the projector is "unlocked," then, once the wireless image transmitter **500** starts the session **125**, the projector's state changes to "locked." The state returns to "unlocked" when the session **125** concludes. In one embodiment, protocols such as Universal Plug and Play protocol are exploited to enable the projector states to be sent in response to queries. However, other proprietary methods could be employed without departing from the principles of the present invention.

[**0063**] At block **550**, if necessary, a command to activate the locked projector **130**, including turning on the projector light source, is issued by the wireless image transmitter **500**. Once the presentation projector **130** is locked and activated, the wireless image transmitter **500** can initiate the wireless image transmission session **125** at block **560** using a peer-to-peer connectivity protocol such as Universal Plug and Play or a client-server data protocol such as the Microsoft Remote Desktop Protocol (RDP), the Citrix Independent Computing Architecture (ICA) protocol, or the International Telecommunications Union (ITU) Protocol T.120 protocol, and a transport protocol such as TCP/IP.

[**0064**] In one embodiment, once the projector wireless image transmission session **125** has been established, the wireless image transmitter **500** triggers the performance of the screen scraper sender logic **200** at block **570**. At block **580**, the wireless image transmitter **500** initiates the transmission to the presentation projector **130**, using the above-described data and transport protocols, of the subset image data **118** and associated header data **117** as generated by the screen scraper sender logic **200**.

[**0065**] Once the header data **117** and subset image data **118** arrives at the presentation projector **130**, performance of the screen scraper receiver logic **300** is automatically triggered at block **590**. The screen scraper receiver logic **300** uses a wireless to DVI graphics engine **400** to render the transmitted subset image data **118** to a bitmap and update the video memory buffer **131** resident in the presentation projector **130** in accordance with the associated header data **117**. At block **595**, the presentation projector **130** projects the updated image **145** to the projection display surface **140**. At block **597**, the wireless image transmitter **500** continues to operate in the above-described fashion by returning to block **570** and repeating the functions of blocks **570**, **580**, **590**, and **595**, until the wireless image projection session is terminated by the user/presenter **150** via the user interface **116** of the image generation device **110**, or some other event that interrupts the session **125**.

[**0066**] Using the above-described method for wireless image transmission to a projector, the entire image served by the image generation device **110** is effectively "compressed," because, after the initial transmission of the image, only a subset of the digital image data generated by the image generating device **110** is actually transmitted over the wireless link **120**. Unlike prior art projector systems, where over 1 Gigabit/second data rate is required for transmission of a typical XGA image, even when that image is a still image, the wireless image transmission of the present invention requires only a fraction of that data rate. Even if every pixel in the XGA image suddenly changes, a worst case delay of only approximately 1.7 seconds is required to update the projected image **145** using the method and apparatus of the present invention. Since most presentations contain fairly static images, the typical delay time is significantly less so as to be imperceptible or nearly so to the user/viewer/presenter **150**. The performance of the method and apparatus for wireless image transmission to a projector **100** is therefore superior to prior art projection systems and is particularly well suited to transmitting images wirelessly. It should be noted, however, that the method and apparatus may also be applied to a conventional wired image transmission without departing from the principles of the present invention.

[**0067**] **FIG. 14** illustrates a data flow diagram of the method and apparatus for wireless image transmission to a projector illustrated in **FIG. 1** in accordance with one embodiment. As shown, a raster graphics image data **605** or vector graphics image data **610** is captured from a video memory buffer into a screen scrape **615**. In one embodiment, a delta subset of the captured image data from one screen scrape to the next, that can be encompassed by a smallest bounding rectangle **620** is saved in a projector output buffer. The delta subset of the captured image data is compressed **630** and sent over a wireless transmission link to a projector, where it is decompressed and rendered into a subset image

data **640** in the projector's video memory buffer using the projector's graphics rendering engine. In one embodiment, an SVG format of the captured image data **610** is sent over a wireless transmission link to the projector, where it is rendered into the subset image data **640** in the projector's video memory buffer using the projector's graphics rendering engine. The rendered image is updated to the projected image data **645** in accordance with a descriptive header data **635** associated with the subset image data **640**.

[**0068**] **FIG. 15** illustrates a general-purpose computer system upon which an embodiment of the wireless image transmission to a projector method and apparatus may be implemented. As shown, general-purpose computer system **700** comprises a bus **701**, or other communications hardware and software for communicating information, a processor **705** coupled with bus **701** for processing information, and a Universal Serial Bus (USB) host controller for controlling USB devices. Computer system **700** further comprises a random access memory (RAM) or other dynamic storage device **702** (referred to as main memory), coupled to bus **701** for storing information and instructions to be executed by processor **705**. Computer system **700** also comprises a read only memory (ROM) **703**, and/or other static storage device, coupled to bus **701** for storing static information and instructions for processor **702** (referred to as static memory). Mass storage device **704** is coupled to bus **701** for storing information and instructions. Furthermore, mass storage device **704**, such as a magnetic disk or optical disk, and its corresponding disk drive, can be coupled to computer system **700**. Computer system **700** can also be coupled via bus **701** to a display device **721** for displaying information to a computer user such as a network manager. Display device **721** is used to display windows containing a graphical user interface to the available electronic assets managed by the electronic asset lending library. Display device **721** can include a frame buffer, specialized graphics rendering devices, a cathode ray tube (CRT), and/or flat panel display. An input device **722**, including alphanumeric and other keyed devices, or even a audio voice input device, is typically coupled to bus **701** for communicating information and command selections to processor **705**. Another type of user input device is cursor control device **723**, such as a mouse, a trackball, a pen, a touch screen, or cursor direction keys for communicating direction information and command selections to processor **705**, and for controlling cursor movement on display device **721**. This input device typically has two degrees of freedom in two axes, a first axis (e.g., the x-axis) and a second axis (e.g., the y-axis), which allows the device to specify positions in a plane. However, this invention should not be limited to input devices with only two degrees of freedom.

[**0069**] Another device that may be coupled to bus **701** is a hard copy device **724** which may be used for printing instructions, data, or other information on a medium such as paper, film, or similar types of media. Additionally, computer system **700** can be coupled to a device for sound recording, and/or playback **725**, such as an audio digitizer coupled to a microphone for recording information. Further, the device may include a speaker that is coupled to a digital to analog (D/A) converter for playing back the digitized sounds.

[**0070**] Network interface card **726** is coupled to bus **701**. Network interface card **726** is further coupled to an external computer network such as a wireless local area network according to the IEEE 802.11, IEEE 802.11b, IrDA, and Bluetooth implementations. Network interface card **726** includes a wireless network interface card which, in conjunction with appropriate data communications protocols (e.g. Microsoft RDP, Citrix ICA, or the ITU T.120 protocols) and transport protocols (e.g. TCP/IP), provides the means by which the image generation device **10**, wireless image transmitter **500**, screen scrape sender **200**, **10** screen scrape receiver **300**, presentation projector **130**, and wireless to DVI graphics engine **400**, exchange information with each other as well as other devices or application logic coupled to the same computer network. Modem **727** is coupled to bus **701**, and provides an alternate means of exchanging information with other devices for which a modem connection to an external computer network or device (not shown) can be established.

[**0071**] Computer system **700** and the wireless image transmission application software logic or program modules, stored and executed therein as part of the method and apparatus for wireless image transmission to a projector, operate in conjunction with an operating system with graphics capability and a terminal server capability, such as the Microsoft Windows operating system with the graphics device interface (GDI) and terminal services advanced client (TSAC). Commercially available computer systems implementing the features of general-purpose computer system **700** include a broad range of operating system-based computers, including server computers, desktop computers, workstations, personal digital assistants, devices, or computer appliances.

[**0072**] Referring now to FIGS. **1-15** together, it should be apparent that some or all of the above-described functions of the wireless image transmission method and apparatus **100** may be performed by one or more of the image generation device **110**, the presentation projector **130**, or by associated server computers in a variety of network configurations. In particular, some of the components of the image generation device **110** and presentation projector **130** may reside in part on network servers **160** that communicate with the image generation device **110** or with the presentation projector **130** over an intranet or Internet, or over a local area or wide area network or combination of networks, or any other network configuration capable of connecting them.

[**0073**] Accordingly, a novel method and apparatus is described for a wireless image transmission to a projector, so as to enable the remote control of and image transmission to presentation projector resources in a wireless network enterprise environment. From the foregoing description, those skilled in the art will recognize that many other variations of the present invention are possible. In particular, while the present invention has been described as being comprised of a screen scraper sender logic **200**, screen scraper receiver logic **300**, wireless to DVI graphics engine **400**, and wireless transmitter logic **500** components, and being implemented on an image generation device **110** and a projector **130**, some of the functions of these components may be distributed in other components of one or more general-purpose computer systems **700**. Thus, the present invention is not limited by the details described. Instead, the present invention can be practiced with modifications and alterations within the spirit and scope of the appended claims.

What is claimed is:

1. A apparatus comprising:

an image generator to generate a subset image data;

an image transmitter to transmit the subset image data over a wireless link; and

a projector, coupled to the image generator via the wireless link, to project an updated image using the transmitted subset image data.

2. The apparatus of claim 1, wherein the subset image data is a delta between a first image data and a second image data, the first and second image data previously generated by the image generator.

3. The apparatus of claim 1, wherein the subset image data is a scalable vector graphics encoding of a graphic primitive previously generated by the image generator.

4. The apparatus of claim 1, further comprising:

a header data that describes the subset image data, wherein the projector projects the updated image in accordance with the header data.

5. The apparatus of claim 1, wherein the subset image data is transmitted only after receiving a permission from the projector.

6. The apparatus of claim 2, wherein the delta comprises a block of pixels in the second image data that include at least one pixel that is different from a corresponding pixel in the first image data.

7. The apparatus of claim 6, wherein the block of pixels is circumscribed by a smallest bounding rectangle that can encompass the at least one different pixel.

8. The apparatus of claim 1, wherein the image generator is a personal computer.

9. The apparatus of claim 2, wherein the image generator generates a first and second image data by capturing a screen scrape from a video memory buffer.

10. The apparatus of claim 2, wherein the screen scrape is a raster graphics image.

11. The apparatus of claim 6, wherein the delta between the first image data and the second image data is determined by a pixel-by-pixel comparison.

12. The apparatus of claim 11, wherein the pixel-by-pixel comparison includes comparing a value of a pixel that represents an optical state of the pixel.

13. The apparatus of claim 12, wherein the value is a color value.

14. The apparatus of claim 12, wherein the value is a grayscale value.

15. The apparatus of claim 12, wherein the value is an intensity value.

16. A method for transmission of an image comprising:

generating a subset image data; and

transmitting the subset image data to a projector to project an updated image using the subset image data.

17. The method of claim 16, wherein

generating the subset image data comprises determining a delta between a first image data and a second image data, the first and second image data previously generated by the image generator; and

the updated image comprises the projection of the first image data updated with the subset image data.

18. The method of claim 16, wherein transmitting the subset image data to the projector is over a wireless transmission medium.

19. The method of claim 16, wherein transmitting the subset image data to the projector comprises:

discovering the projector via a wireless transmission medium;

establishing a wireless transmission session with the projector; and

obtaining permission from the projector to send the subset image data.

20. The method of claim 19, wherein discovering comprises:

sending a discovery request to a plurality of projectors accessible over the wireless transmission medium;

receiving a discovery reply from at least one of the plurality of projectors; and

selecting a projector from the at least one projector based on a characteristic of the discovery reply.

21. The method of claim 20, wherein the characteristic is a signal strength of the discovery reply, the selected projector having the discovery reply with the strongest signal.

22. The method of claim 20, wherein the characteristic is an order of the discovery reply, the selected projector having sent the earliest discovery reply as compared to the discovery replies sent by the plurality of projectors.

23. The method of claim 17, wherein the delta comprises a block of pixels in the second image data that include at least one pixel that is different from a corresponding pixel in the first image data.

24. The method claim 23, wherein the block of pixels is circumscribed by a smallest bounding rectangle that can encompass the at least one different pixel.

25. The method of claim 16, wherein generating a subset image data is performed by a personal computer.

26. The method of claim 16, wherein generating a subset image data comprises encoding a previously generated graphics primitive into a scalable vector graphics (SVG) format.

27. The method of claim 17, wherein the first and second image data comprise a raster graphics image.

28. The method of claim 17, wherein the delta between the first image data and the second image data is determined by a pixel-by-pixel comparison of pixels in the first image data with pixels in the second image data.

29. The method of claim 28, wherein the pixel-by-pixel comparison includes comparing a value of a pixel that represents an optical state of the pixel.

30. The method of claim 29, wherein the value is a color value.

31. The method of claim 29, wherein the value is a grayscale value.

32. The method of claim 29, wherein the value is an intensity value.

33. An apparatus comprising:

a machine-accessible medium having stored thereon executable instructions to cause a computer to perform

generating a subset image data; and

transmitting the subset image data to a projector to project an updated image using the subset image data.

34. The apparatus of claim 33, wherein

the instructions for generating the subset image data comprises further instructions for determining a delta between a first image data and a second image data, the first and second image data previously generated by the image generator; and

the updated image comprises the projection of the first image data updated with the subset image data.

35. The apparatus of claim 33, wherein the instructions for transmitting the subset image data to the projector is include instructions for transmitting over a wireless transmission medium.

36. The apparatus of claim 33, wherein the instructions for transmitting the subset image data to the projector comprises further instructions for:

discovering the projector via a wireless transmission medium;

establishing a wireless transmission session with the projector; and

obtaining permission from the projector to send the subset image data.

37. The apparatus of claim 36, wherein the instructions for discovering comprises further instructions for:

sending a discovery request to a plurality of projectors accessible over the wireless transmission medium;

receiving a discovery reply from at least one of the plurality of projectors; and

selecting a projector from the at least one projector based on a characteristic of the discovery reply.

38. The apparatus of claim 37, wherein the characteristic is a signal strength of the discovery reply, the selected projector having the discovery reply with the strongest signal.

39. The apparatus of claim 37, wherein the characteristic is an order of the discovery reply, the selected projector having sent the earliest discovery reply as compared to the discovery replies sent by the plurality of projectors.

40. The apparatus of claim 34, wherein the instructions for determining the delta comprises determining that a block of pixels in the second image data that include at least one pixel that is different from a corresponding pixel in the first image data.

41. The apparatus of claim 40, wherein the instructions for determining the delta include circumscribing the block of pixels by a smallest bounding rectangle that can encompass the at least one different pixel.

42. The apparatus of claim 33, wherein the instructions for generating the subset image data is performed by a personal computer.

43. The apparatus of claim 33, wherein the instructions for generating the subset image data comprises encoding the subset image data from a previously generated graphics primitive in a scalable vector graphics (SVG) format.

44. The apparatus of claim 34, wherein the instructions for generating the first and second image data comprise capturing a raster graphics image.

45. The apparatus of claim 33, wherein the instructions for determining the delta between the first image data and the second image data comprise performing a pixel-by-pixel comparison of pixels in the first image data with pixels in the second image data.

46. The apparatus of claim 45, wherein the instructions for performing a pixel-by-pixel comparison includes comparing a value of a pixel that represents an optical state of the pixel.

47. The apparatus of claim 45, wherein the value is a color value.

48. The apparatus of claim 45, wherein the value is a grayscale value.

49. The apparatus of claim 45, wherein the value is an intensity value.

50. A method for transmitting an image to a projector over a wireless transmission medium comprising:

sending a discovery request to a plurality of projectors accessible over the wireless transmission medium;

receiving a discovery reply from at least one of the plurality of projectors; and

selecting a projector from the at least one of the plurality of projectors based on a characteristic of the discovery reply.

51. The method of claim 50, wherein the characteristic is a signal strength of the discovery reply, the selected projector having the discovery reply with the strongest signal.

52. The method of claim 50, wherein the characteristic is an order of the discovery reply, the selected projector having sent the earliest discovery reply as compared to the discovery replies sent by the plurality of projectors.

53. The method of claim 50, further comprising performing the sending, receiving, and selecting automatically in response to a single user action.

54. The method of claim 50, wherein selecting the projector is based on a manual selection made by a user.

55. The method of claim 54, wherein the manual selection is performed by clicking on a projector icon representing the selected projector.

56. An apparatus comprising:

a machine-accessible medium having stored thereon executable instructions to cause a computer to perform

sending a discovery request to a plurality of projectors accessible over the wireless transmission medium;

receiving a discovery reply from at least one of the plurality of projectors; and

selecting a projector from the at least one of the plurality of projectors based on a characteristic of the discovery reply.

57. The apparatus of claim 56, wherein the instructions for selecting a projector select the projector that sent the discovery reply having the characteristic of the strongest signal.

58. The apparatus of claim 56, wherein the instructions for selecting a projector select the projector that sent the discovery reply having the characteristic of the earliest reply as compared to the discovery replies sent by the plurality of projectors.

59. The apparatus of claim 56, wherein the instructions for sending, receiving, and selecting are performed automatically in response to a single user action.

60. An apparatus for rendering an image data into a digital video interface (DVI) format comprising:

a wireless receiver to receive an image data and a header data over a wireless transmission medium;

a decompresser to decompress the image data in accordance with the header data;

a controller to send the decompressed image data to a transistor minimized differential serial (TMDS) transmitter, the TMDS transmitter converting the decompressed image data into the DVI format in accordance with the header data.

61. The apparatus of claim 60, wherein the image data comprises a subset of a digital image data generated by a remote image generation device.

62. The apparatus of claim 60, wherein the header data comprises a plurality of data fields that describe the image data.

63. The apparatus of claim 60, wherein the image and header data are transmitted over the wireless transmission medium as a single packet of data.

64. The apparatus of claim 63, further comprising a parser to parse the single packet of data into the header data portion and the image data portion.

65. The apparatus of claim 60, further comprising a decoder to decode the image data in accordance with the header data, and wherein the controller sends the decoded image data to the TMDS transmitter, the TMDS transmitter converting the decompressed image data into the DVI format in accordance with the header data.

66. A projector for projecting images transmitted over a wireless transmission medium comprising:

a receiver to receive a digital image data representing an image transmitted over a wireless transmission medium in response to a remote request;

a graphics engine to generate a digital video image (DVI) format from the received digital image; and

a projector to project the DVI formatted digital image to a viewable surface.

67. The projector of claim 66, wherein the received digital image data comprises a subset image data and a header data, the header data describing the subset image data.

68. The projector of claim 67, wherein the subset image data comprises a delta between a first image data and a second image data, the first and second image data previously generated by an image generator.

69. The projector of claim 67, and wherein the graphics engine generates the DVI format of the subset image data in accordance with the header data.

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