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(54) INTERACTIVE VIRTUAL CLASSROOM

(76) Inventors: **Mehdi Asgarinejad**, Irvine, CA (US); **Michael A. Corgan**, Moreno Valley, CA (US)

Correspondence Address:
Mitchell B. Wasson, Esq.
HOFFMAN, WASSON & GITLER, PC
Suite 522
2361 Jefferson Davis Highway
Arlington, VA 22202 (US)

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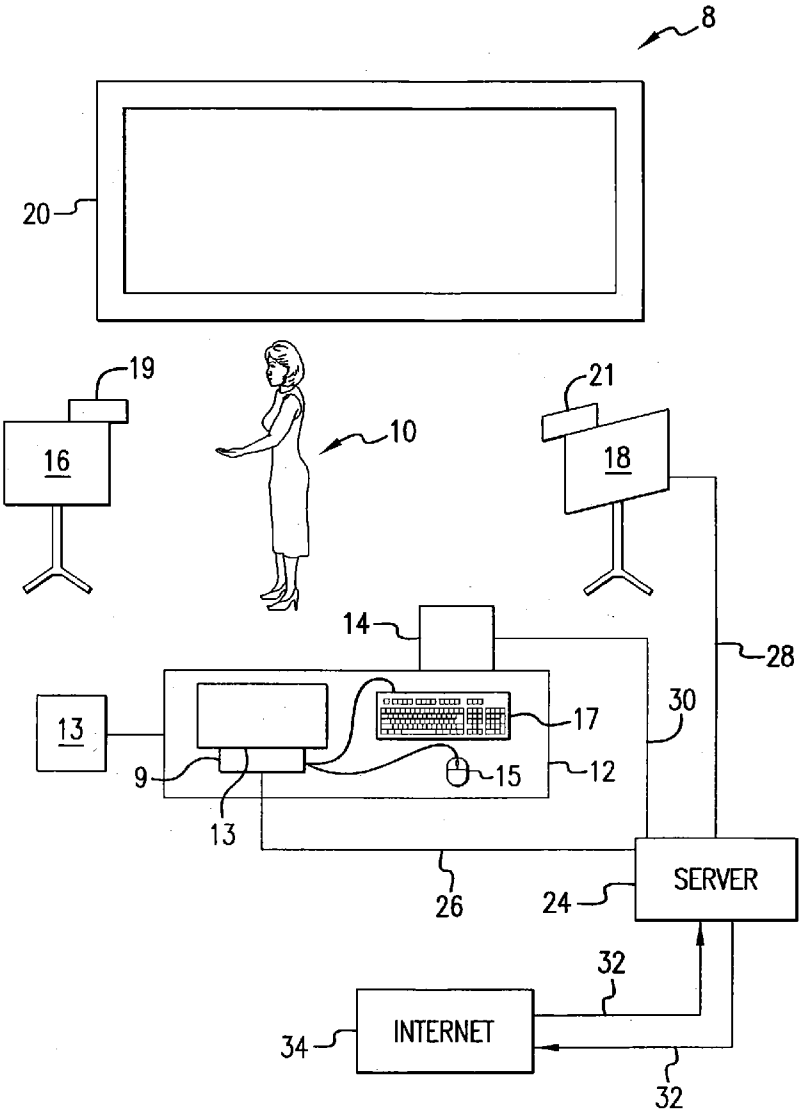
(57) **ABSTRACT**

A system for allowing interactivity between an instructor provided with an instructor's workstation and a plurality of student's monitoring student workstations all of which are remote with respect to each other. A video and audio presentation would be transmitted in real time from the instructor's workstation to each of the student's workstation. Each of the student's workstation would include a monitor for displaying a video portion of the instructor's presentation as well as including response buttons for answering various questions posed by the instructor. The instructor's workstation would include a monitor for displaying the student's responses to the instructor's questions.



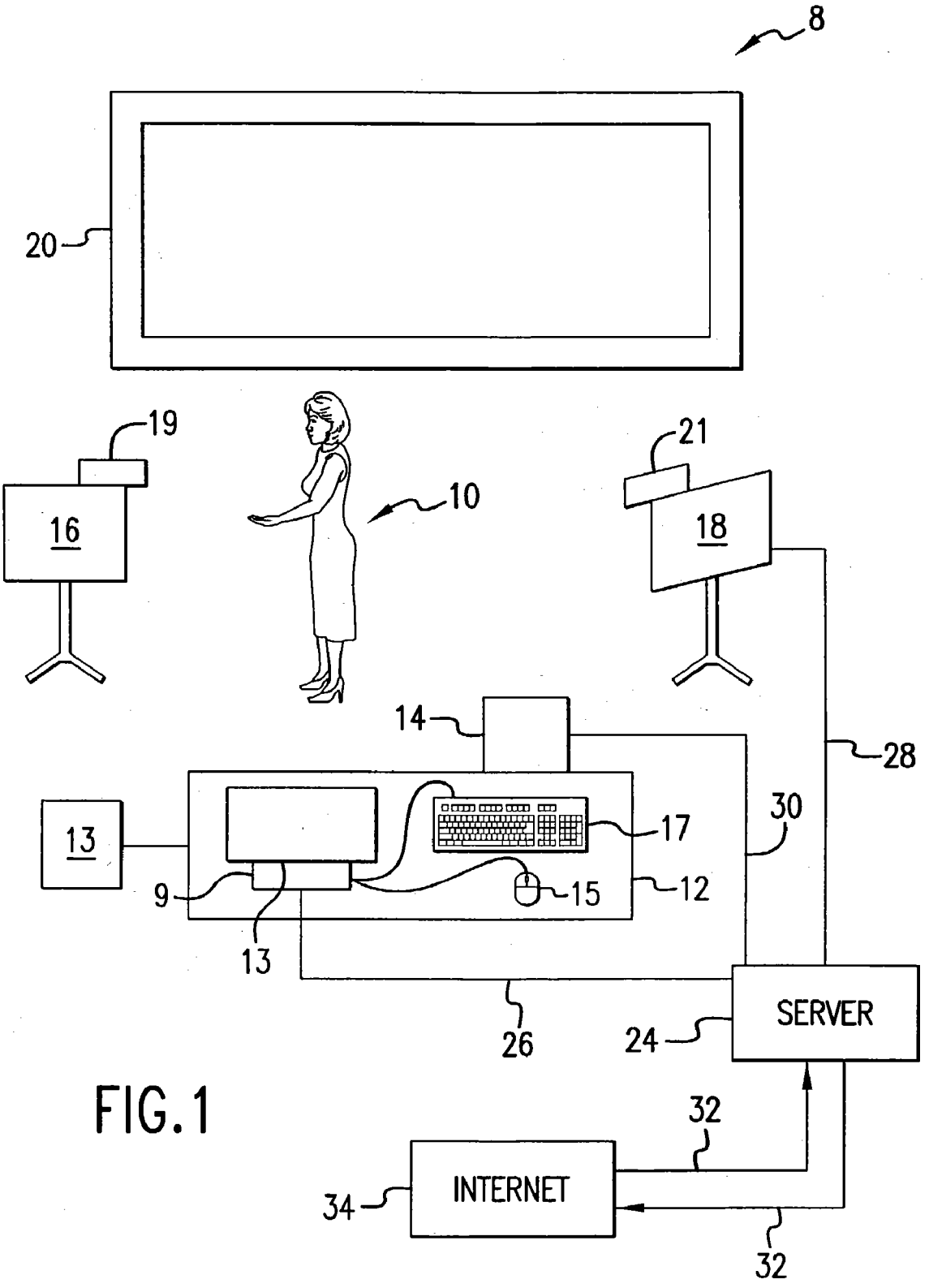

8
20
19
16
10
21
18
14
28
13
17
30
9
15
12
13
26
SERVER
24
32
INTERNET
34
32

FIG. 1

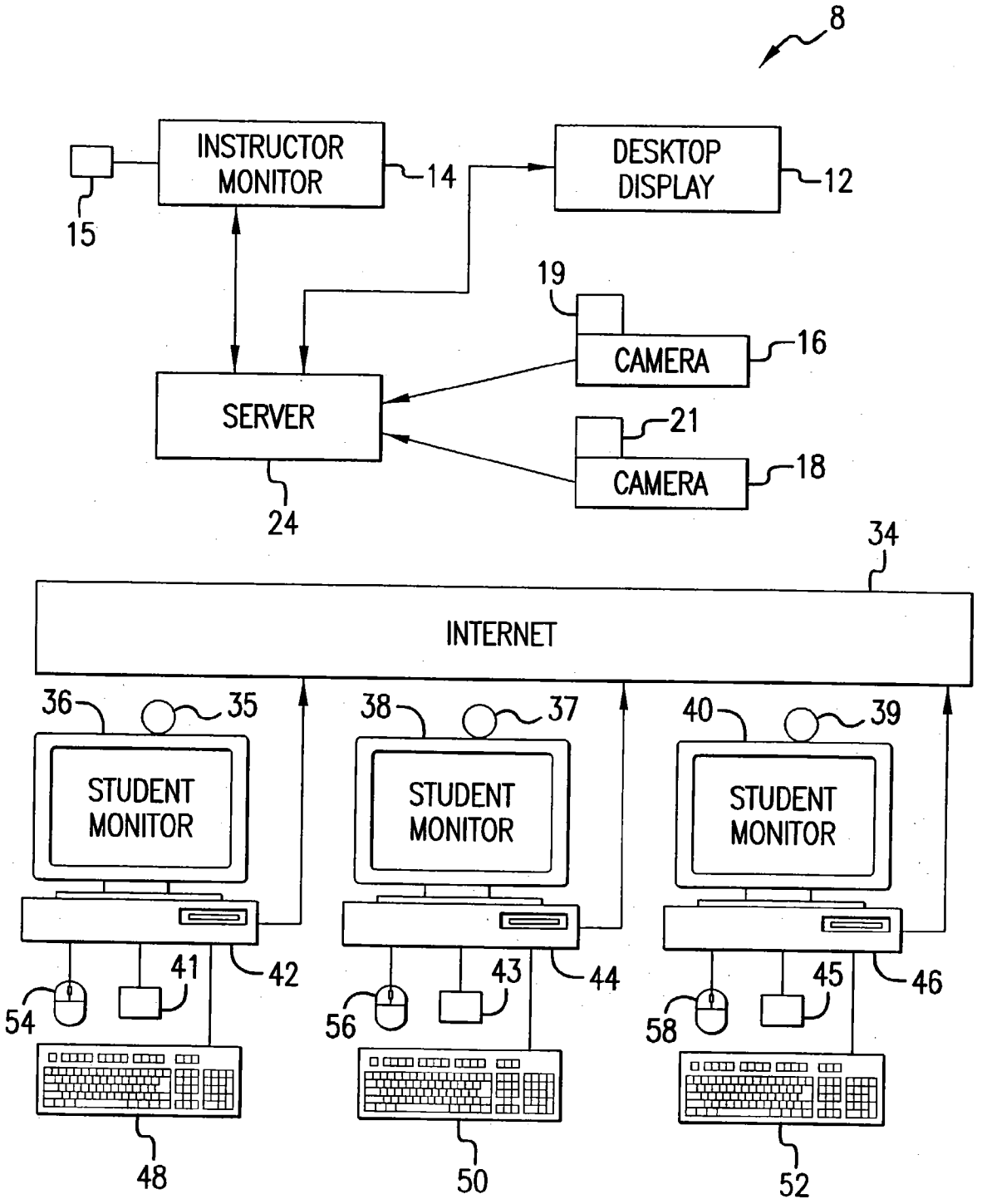

8
INSTRUCTOR MONITOR
14
DESKTOP DISPLAY
12
15
19
CAMERA
16
SERVER
21
CAMERA
18
24
34
INTERNET
36
35
38
37
40
39
STUDENT MONITOR
STUDENT MONITOR
STUDENT MONITOR
41
42
43
44
45
46
54
56
58
48
50
52

FIG.2

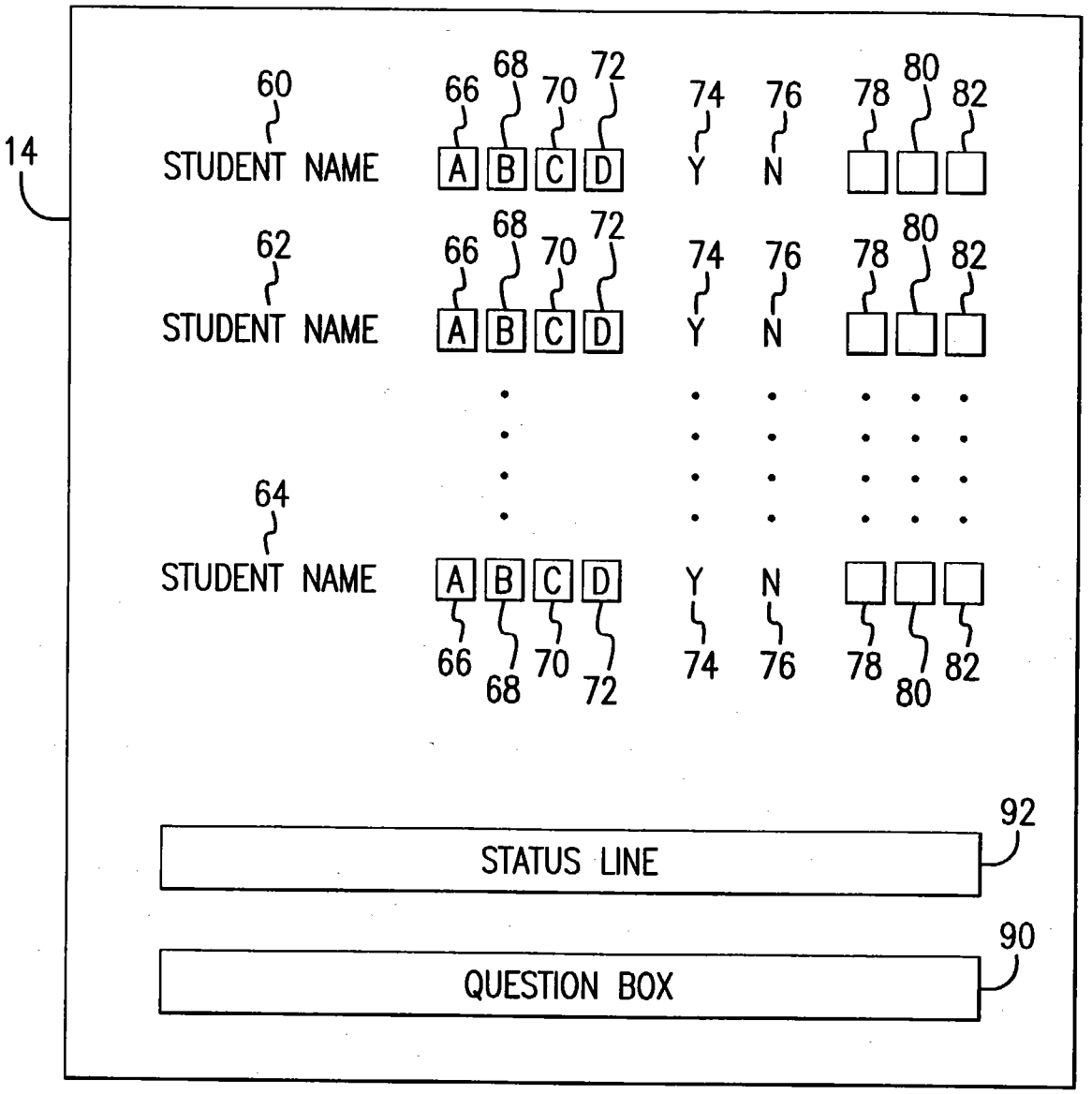

14
60
62
64
STUDENT NAME
STUDENT NAME
STUDENT NAME
66
68
70
72
74
76
78
80
82
A
B
C
D
Y
N
STATUS LINE
92
QUESTION BOX
90

FIG.3

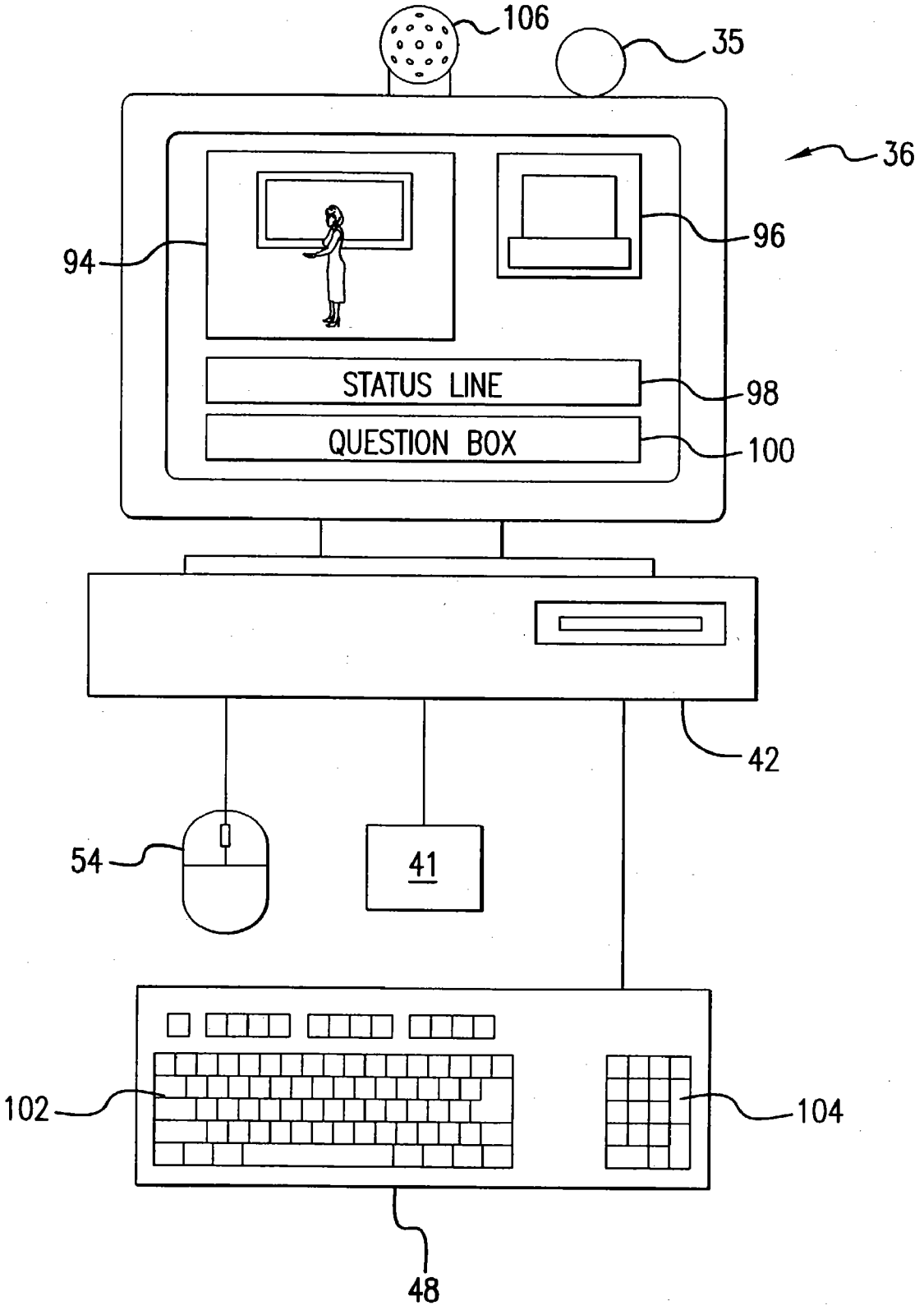

106
35
36
94
96
STATUS LINE
98
QUESTION BOX
100
42
54
41
102
104
48

FIG.4

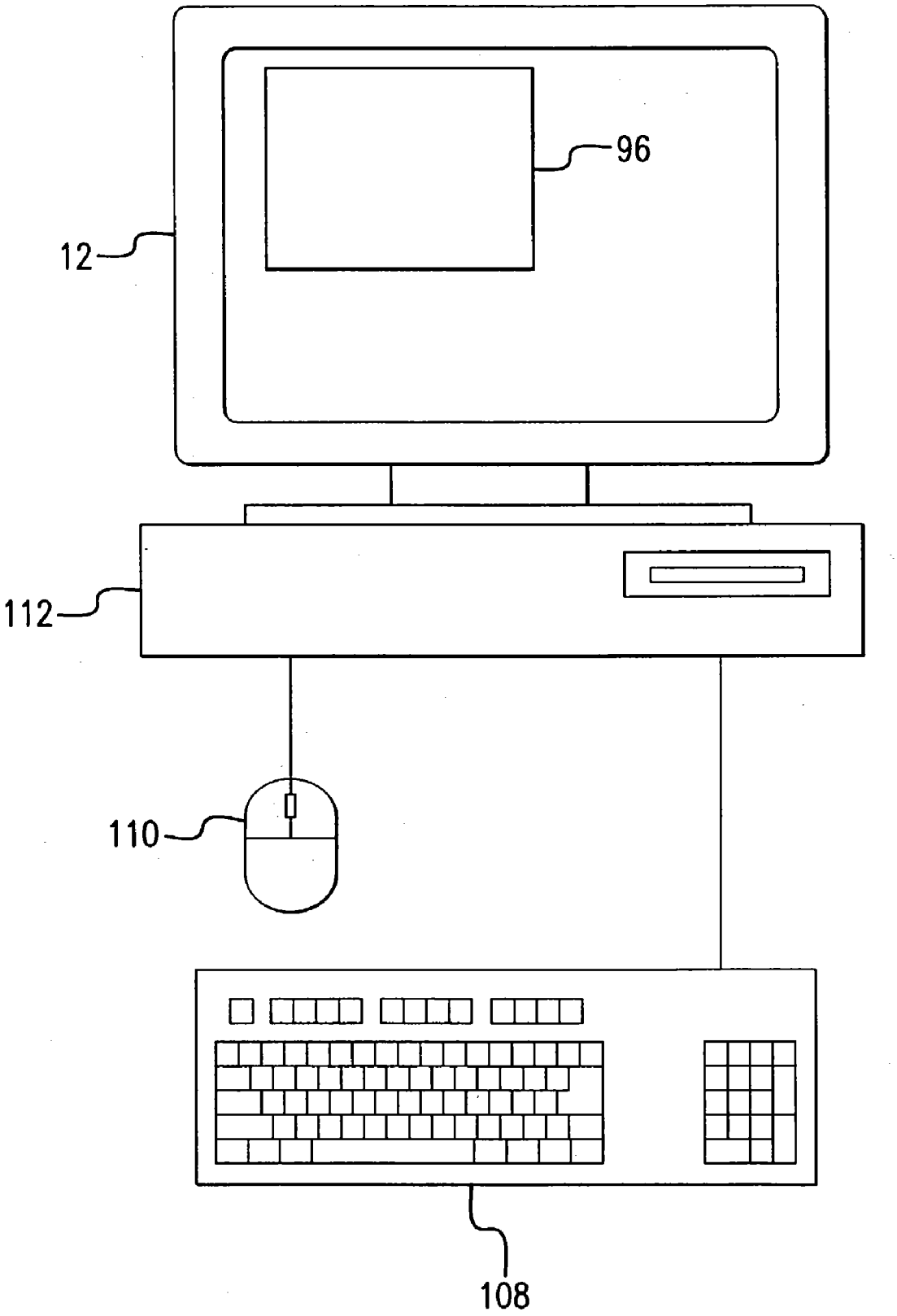


FIG.5

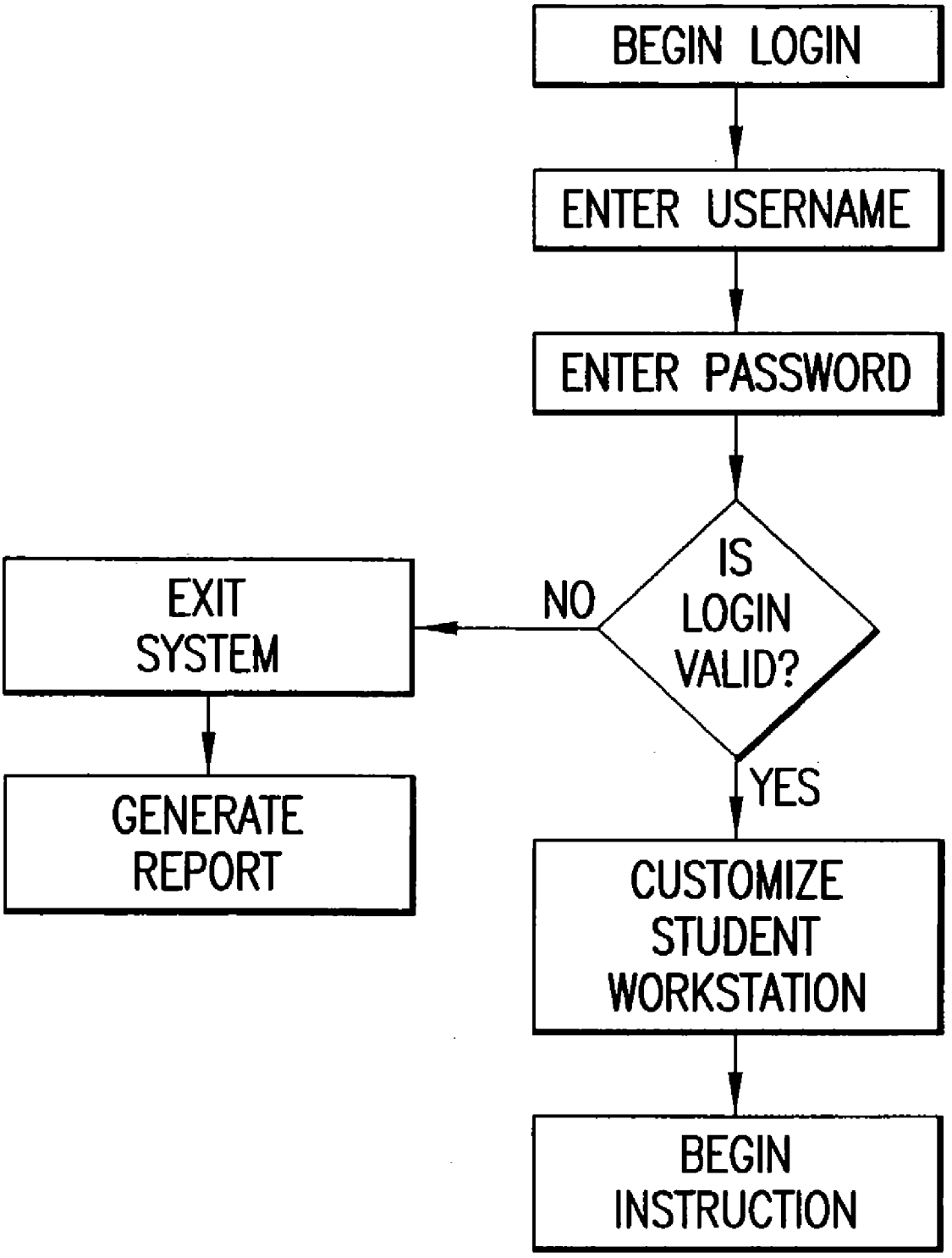

BEGIN LOGIN
ENTER USERNAME
ENTER PASSWORD
IS LOGIN VALID?
NO
EXIT SYSTEM
GENERATE REPORT
YES
CUSTOMIZE STUDENT WORKSTATION
BEGIN INSTRUCTION

FIG.6

INTERACTIVE VIRTUAL CLASSROOM

FIELD OF THE INVENTION

[0001] The present invention is directed to an interactive teaching system in which a lecturer is located at a remote location from the students.

BACKGROUND OF THE INVENTION

[0002] Conventional brick and mortar have, by their very nature, a limited capacity to accommodate students due to space considerations. Once all available classroom space is filled, no other students can attend that class, thereby limiting the availability of educational opportunities for certain segments of the potential student body. This would also limit tuition paid to these institutions due to lack of facility space. An instructor in a conventional classroom can only teach those students who are physically present in that classroom. Transportation availability, distance and cost may all conspire to limit or even to preclude student attendance. Furthermore, an institution of higher learning may not have an instructor on staff that is qualified to teach a certain subject, or the classroom sessions for a particular instructor who is versed in that subject matter may be filled to capacity. Short of the expensive proposition of building new or expanding old facilities, the conventional classroom based institution is not capable of the rapid expansion needed to meet the educational demands of our burgeoning information age. Even if classroom space was available, the lack of qualified instructors (particularly since shortages of teachers are forecast for the next decade) would greatly limit the opportunity for students to be instructed in various courses of study.

[0003] At the present time, a fortuitous combination of technology used to provide information in a nearly real-time time frame, coupled with the communications industry, has allowed for the creation of remote learning capabilities in which a lecturer is at a remote location with respect to the students. This type of technology has been detailed in a number of U.S. patents.

[0004] For example, U.S. Pat. No. 5,437,555, issued to Ziv-El, describes a remote teaching system wherein one or more groups of students located at one or more remote learning centers is taught by a teacher located at an instruction center. Each student at the learning center is provided with a terminal, including an alphanumeric keyboard, a multi-line LCD, visual reinforcement devices, an audio reinforcement device, a terminal identification device, a local controller and an audio-visual output port. A student's response generated by a teacher's question would be stored in respective response buffers. Information from these buffers is transmitted to the teacher's terminal and are displayed thereon. A social mode means is provided for coordinating each of the participant terminals within a learning center to collectively respond to a particular question indicated by a teacher. However, it is important to note that the patent. to Ziv-El operates in an environment in which a plurality of students are located at the same learning center. Each of the students is supplied with their own computer and the learning center is provided with an extra computer for coordinating the responses generated by the students based upon a question posed by the teacher. Additionally, the patent to Ziv-El does not provide a system in which a student at the student's own console would be able to control the operation of the teacher's console.

[0005] U.S. Pat. No. 6,282,404, issued to Linton, describes a method and system for accessing multi-media data in an interactive format having reporting capabilities. The system includes a means for streaming an instructional segment to a user, as well as evaluating the user's comprehension of the instructional segment and reporting the results of the instructional segment to an administrator. A means is also included for granting the user access to the instructional segment via a user handle and a private password that are corroborated by a database system when the user accesses the instructional segment. However, this patent is directed to a system in which prerecorded data in the form of the instructional segment, is transmitted to the ultimate user.

[0006] U.S. Pat. No. 6,074,216, issued to Cueto, describes a system for providing an interactive education process. Individual students are at remote sites and are provided with computer terminals having computer network connections to an interactivity engine which receives inquiries and comments from the students through the network connections. The computer network connection to the interactivity engine provides the capability of feedback allowing the instruction to be structured around this feedback. The interactivity engine categorizes the student inquiries and comments and presents them in an ordered fashion to personnel in a studio represented by a stage manager. The stage manager then relays this information to an instructor for broadcast response. It is clear that the patent to Cueto does not describe a system in which students' responses to an instructor's questions are not directly displayed on the instructor's monitor in a real-time manner.

[0007] U.S. Pat. No. 4,759,717, issued to Larochelle et al, discusses a teaching system employing a teacher controller device which is serially connected with a plurality of computer stations in a closed loop circuit. Each of the computer stations is designed to be utilized by students that would include a computer device, as well as a video monitor interconnected to one another through an interface unit. A control signal is generated to condition each of the computer stations to operate in either an individual mode, a source mode or a target mode. In the individual mode, the video signals issued from each individual computer are displayed on its associated video monitor. In the source mode, a video output screen connection and a computer input are connected directly to the closed loop network cable through buffers. In the target mode, video output cannot be displayed on the video monitor. The Larochelle et al system does not allow for responses to a teacher's inquiry to be displayed on the teacher's monitor. Additionally, this patent does not relate to a system in which students can control the teacher's desktop display area.

[0008] U.S. Pat. No. 4,715,818, issued to Shapiro et al, details a computer training system including an instructor workstation and a plurality of student workstations. The instructor workstation includes a personal-type computer, a computer video monitor and a video switching system for selectively connecting each of the student workstation computers and their respective video monitors to the instructor's workstation video monitor. There is no recitation in this patent allowing a student to operate the instructor's workstation or showing student responses to the instructor's inquiries to be displayed on the instructor's video monitor.

[0009] U.S. Pat. No. 4,538,993, issued to Krumholz, describes a computer teaching system including a teacher station having a computer and a teacher's display, as well as a plurality of student computers connected a teacher switching console. The teacher switching console has the capability of selectively connecting any computer display signal output to any student display screen. Similar to the Shapiro et al patent, the patent to Krumholz illustrates a scheme allowing various of the student computers to be connected to the teacher's display.

[0010] U.S. Pat. No. 6,381,444, issued to Aggarwal et al shows a system for implementing virtual class and distance education in which lesson material is sent in advance to student entities when network usage is low. Although this patent does contemplate a situation in which a live presentation from an instructor is transmitted to the student entities and the student is allowed to query the instructor during various portions of the lessons, this patent does not describe a system in which student responses to instructor's questions are displayed on the instructor's monitor, as well as stored for further examination. Additionally, this patent does not contemplate a situation in which the student can control the instructor's computer desktop in real-time.

[0011] U.S. Pat. No. 4,652,240, issued to Wackym, shows an interactive training system for training students to use a computer. This system includes an instructor's station, as well as a plurality of student stations. Each of the student's stations includes a control means comprising a two-position switch for connecting each of the student's monitors to the instructor's computer, as well as connecting the student's monitor to the student's computer. Although this patent gives the instructor the ability to dynamically demonstrate every input being displayed on the instructor's monitor, there is no direct interaction between each of the students and the instructor.

SUMMARY OF THE INVENTION

[0012] The deficiencies of the prior art are addressed by the present invention which relates to a virtual classroom or learning system providing interactivity between a lecturer and one or more students, each remotely located with respect to the lecturer. This virtual classroom is designed to allow the remote students at any location to synchronously attend a live class and participate during the class session, and create and submit class work assignments for instructor review. The virtual classroom provides a conduit for connectivity, overcoming the barriers of geographic location and the physical limitation of the brick and mortar institution, thereby bringing the student and the instruction into a learning space without physical barriers. The virtual classroom is not an educational system. It is rather the tool to extend the reach of classroom instruction to students who would otherwise be unable to attend classes.

[0013] The virtual classroom includes, at the instructor's location, an instructional workstation for the presentation of educational materials and a student interactivity monitor/control workstation, as well as a plurality of student workstations at a remote location. Although it is possible that several of the student workstations can all be located in a single central area remote from the instructor's workstation, in a preferred embodiment each of the students' workstations are not only remote with respect to the instructor's location, but are also remote with respect to each other's workstation.

[0014] The instructional workstation would include a desktop computer provided with all of the standard tools utilized with a computer, such as a keyboard, a mouse and a video monitor. One or more camera stations are provided adjacent to the instructor's location allowing video and audio of the instructor's presentation to be encoded and transmitted in real-time to the students' workstations. One of the cameras would be trained on the instructor during the instructor's presentation and a second camera would be trained upon the instructor's desktop, allowing display of printed materials or three-dimensional objects. Obviously, it might be possible to utilize only a single camera to transmit and perhaps record both of the aforementioned functions by allowing the camera to be rotated to view different areas, either remotely, or with the benefit of a technician. A microphone would be associated with one or more cameras or would be placed in proximity of the instructor's workstation to allow an audio broadcast of the instructor's presentation, either in concert with the video presentation, or without the benefit of the video presentation. Certainly, other instructional implements, such as a blackboard or slides, could also be included in the instructor's workstation.

[0015] Each of the student's workstations would include a computer provided with a video display area allowing the students to see the instructor's presentation. A speaker would also be included in the student's workstation to also allow the students to hear the instructor's presentation. The monitor would also include a second video display area in which the instructor's desktop display area is projected upon each of the students' monitors.

[0016] A keyboard and mouse would be associated with each of the computers allowing each student to separately interact with the instructor in an intuitive, rapid manner. A standard keyboard could be utilized or a specialized keyboard would be implemented having specific response buttons.

[0017] The instructor's monitor/control workstation would also include a video monitor upon which would be viewed each of the students interactivity with respect to various questions posed by the instructor in the instructor's presentation. The monitor/control workstation would also allow the instructor to select different optional configurations for student interactivity.

[0018] Each of the students' monitors would include a status line section giving positive confirmation that a student's response has been received by the instructor. Furthermore, a question box would provided on the video monitor allowing the student to type a question or comment and send this question or comment to the instructor.

[0019] Each of the students' monitors and/or keyboards would include a variety of buttons or icons to allow the student to respond to and interact with the instructor. Typical responses might include a yes or no answer, a multiple choice quiz response, or a raised hand indicator showing the instructor's questions or questions and comments generated by whether the student desires interactivity.

[0020] Each of the students' workstations would include a camera and appropriate video capture hardware and software to allow a real time image of the student to be transmitted to the instructor's monitor/control workstation upon selection by the instructor. This image would also be

capable of retransmission to all of the connected students at the discretion of the instructor.

[0021] Each of the students' workstations would include a microphone and appropriate audio hardware and software to allow the student, upon selection by the instructor, to verbally interact with the instructor, in real time, either in concert with video from the student workstation, or without the benefit of the video image. The audio from the student workstation, either in concern with video or image of the student transmitted to the instructor's monitor/control workstation, upon selection by the instructor would also be capable of retransmission to all of the connected students at the discretion of the instructor.

[0022] Communication between the instructor's workstation and each of the students' workstations would be accomplished in any known communication means, such as utilizing the Internet, employing a standard telephone line or a dedicated line, or any other type of communication such as a wireless communication. Although it is contemplated that there would be no direct communication between a first student's workstation to a second student's workstation, it is conceivable that such a connection would be utilized, particularly if this communication utilized the instructor's workstation as an intermediary.

[0023] A server system would be provided to control the operation of the entire system. This server system would contain one or more microprocessor based servers provided with the appropriate programs to run the system, as well as the appropriate memory to store the various responses to the instructor's questions or questions and comments generated by each of the students.

[0024] A testing system utilizing encrypted communications and accessed via a web browser utilizing secure login provides for evaluation of student progress. Text, video, audio, graphics, and images may be used to either ask or answer questions. Questions may be of a yes or no, multiple choice, or essay type. A subset of a large question pool may be automatically selected by the testing server software for presentation to the student. All questions may be selected for randomization to present a unique test to each student. Yes or no and multiple choice questions may be automatically graded by the server software, and, at the discretion of the test administrator, the results may be presented to the student upon completion of the test via dynamic web page or e-mail. Proctored testing is secured by means of a dual login requirement that verifies the presence of an authorized testing monitor at each student location.

[0025] Students may access a database containing hyperlinks to text, photos, graphics, audio, and video for inclusion with assigned class projects. This database would contain fully searchable text transcripts of each audio or video segment linked by time code to the appropriate media segment, and would also contain metadata relating to a generic classification system describing the classification of each media item as to subject, location, principal participant, date of creation, copyright ownership, and other data as appropriate to allow fully indexed searching of the available materials. Type of media, location, and a fixed length thumbnail preview of the media matching the search criteria would be returned to the student for review. The student may then, in the case of audio or video materials, adjust the starting point and ending point of the media chosen for inclusion with the class assignment. For materials not in the Public Domain, a per use fee determined by the copyright holder for the selected portion of the media would then be determined and charged to the student for the materials used.

[0026] The student class assignments, in the form of HTML documents, and including any materials accessed by hyperlinks, would be transmitted to the instructor for review and grade assignment via e-mail attachment or FTP to a web server.

[0027] These and other objects and advantages of the present invention will no doubt become obvious to one of ordinary skill in the art after having read the following detailed description of the preferred embodiments which are illustrated in the various drawing figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] **FIG. 1** illustrates a perspective view of an instructor and the instructor's workstation;

[0029] **FIG. 2** is a block diagram showing a possible configuration of the system according to the present invention;

[0030] **FIG. 3** is a block diagram showing one possible configuration of the instructor's monitor;

[0031] **FIG. 4** is a diagram showing a typical student's workstation;

[0032] **FIG. 5** is a diagram showing a possible configuration of the instructor's desktop; and

[0033] **FIG. 6** is a drawing showing the log-on procedure according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0034] **FIG. 1** illustrates the instructor's workstation area **8**. Although the instructor **10** is shown in a studio setting, it can be appreciated that, although the present invention is directed to instructing students at a remote location, this can be accompanied by the instructor's presentation made to students in the instructor's classroom, as well as transmitting the presentation to students located at remote terminals. The instructor's workstation would include a desktop **12** provided with a monitor **13** and other devices such as a keyboard **17** and a mouse **15** and a processor to manipulate screens or other software applications which will be transmitted to each of the remote students' workstation. A second monitor **14** is also included for providing a display allowing interactivity between the instructor **10** and each of the remote students. This particular monitor will be described in more detail herein below. Since the main purpose of the present invention is to allow a live presentation of the instructor's lesson to the students situated at a remote location, one or more cameras **16**, **18** must be employed. One of the cameras would be pointed in the direction of the instructor, allowing the instructor's presentation to be properly transmitted. Since the instructional computer desktop display is also transmitted to each of the remote students, camera **18** is directed at the instructor's physical desktop, allowing the transmission of objects displayed to the camera by the instructor. Furthermore, the instructor's workstation could also include other instructional aids, such as a blackboard **20**. Therefore, one or more of the cameras could also

be directed at the blackboard **20**. Each of the cameras would be operated by a technician or would be rotated under the control by the instructor to insure that the cameras are pointed in the proper direction. One or more microphones **19**, **21** would be included. These microphones could be associated with one or more of the cameras or be independent therefrom. A server system **24** is provided to control the transmission of any and all information from the instructor's workstation to the students' workstations, as well as receive responses from each of the students' workstations to be viewed on monitor **14**. Therefore, appropriate communication lines **26**, **28** and **30** are provided between equipment located at the instructor's workstation and the server **30**. Similarly, one or more communication lines **32** would be included to provide communication between each of the students' workstations and the instructor's workstation. Various hardware and software components would be provided to allow for this communication of information between the instructor's workstation and the remote student workstations, as well as for processing and displaying the students' responses to various questions posed by the instructor onto the monitor **14**.

[**0035**] A block diagram of the entire system is shown in **FIG. 2**. This diagram includes the configuration of the instructor's workstation **8**, as well as showing a plurality of remote student workstations. As shown in **FIG. 1**, an instructor's desktop console **12**, including various input devices such as a keyboard, mouse or other type of cursor would be provided. This desktop console could also include a monitor. A second monitor **14** is provided, allowing interactivity between the instructor and one or more of the remotely located students. A speaker **15** is associated with the instructor's monitor **14**. Information from the desktop console **12**, the monitor **14**, as well as cameras **16**, **18** including a microphones **19**, **21**, are transmitted to the server **24**. Video, audio, as well as other types of information, are sent from the server **24** to be received by each of the students' workstations. This type of communication can easily be accomplished through the use of the Internet **34**.

[**0036**] Each of the students' workstations would include respective monitors **36**, **38** and **40**, as well as respective personal computers or other types of processors **42**, **44**, **46**. Furthermore, each of the student workstations would include input means, such as respective keyboards **48**, **50** and **52**, as well as respective mouse inputs **54**, **56**, **58**. A particular student workstation will be described in more detail herein below. Although **FIG. 2** appears to show all of the student workstations at a central location, albeit remote from the instructor's workstation **8**, this is generally not going to be the case. More preferably, each of the students' workstations would be remote, not only the instructor's workstation **8**, but also each of the other students' workstations. Each student monitor can be provided with a camera or other video device **35**, **37**, **39** to allow the instructor to view each respective student on the instructor's monitor **14**. Microphones **41**, **43**, **45** are associated with one of the student's monitors to allow each student to provide an audio input transmitted to the instructor's speaker **15**.

[**0037**] **FIG. 3** illustrates the monitor **14** provided at the instructor's workstation **8**. The purpose of this monitor is to allow the instructor to view responses to various questions posed by the instructor during the instructor's presentation. This display **14** should not be confused with the desktop monitor utilized by the instructor during the class presentation. As shown in **FIG. 1**, the monitor **14** is connected to the server **24** which in turn is connected to the communications network allowing information to be transmitted to the instructor's workstation **8** from each of the remote students' computers. This monitor **14** is the instructor's link to the students' interactivity. The monitor displays the name of each student **60**, **62**, **64** participating in the class session and informs the instructor in a variety of ways of the students' interactivity with the class session. For example, each of the students would have a plurality of response buttons A, B, C and D, **66**, **68**, **70**, **72** associated with each of the students. These response buttons would indicate a response generated from each student based upon a question posed by the instructor. Alternatively, response buttons **74**, **76** referring to "yes" or "no" responses could also be provided. Icons **78**, **80** and **82** might indicate that a particular student has a question which would be subsequently posed to the instructor. Color indicators, text color, pop-up text display boxes and other icons could be used to facilitate communication and interactivity with the instructor.

[**0038**] A question box **90** is provided to allow a student to type a question or comment directed to the instructor. Although the present hardware contemplated to be used in this system would allow up to **1024** characters to be included in the question box **90**, the exact number of characters is not crucial to the present invention. A status line **92** will reflect the time that the questions was received by the software included in the classroom server **24**. The instructor's classroom monitor displays notification, by student name, that a question or comment has been received. The question or comment can only be seen by the instructor and serves to enhance student response by not embarrassing the student who has a question that might not otherwise be asked in front of a classroom full of other students. All questions or comments are logged by the software to allow instructor review at a later time, to determine class participation or to compare a "FAQ" for e-mail to the students.

[**0039**] The students' workstation is illustrated in **FIG. 4**. This workstation represents one of the workstations shown in **FIG. 3**. A monitor **36** is included connected to a processor **42** which in turn is connected to control devices, such as a keyboard **48** and a mouse **54**. The monitor **36** can be divided into several sections although the exact configuration of this monitor **36** is not crucial to the present invention. For example, one section of the monitor **94** would consist of a live picture of the instructor. A speaker **106** provided directly on the monitor or associated therewith, is used to hear the instructor's presentation. A camera **35** would also be provided to all the students' workstations allowing video information generated proximate to the student workstation **36** to be displayed on the instructor's monitor **14**. Additionally, a microphone **41** is also included to allow each student to provide a audio output to be received by the instructor's speaker **15**. Different streaming video compression standards and display area sizes are used primarily dependent upon the user's available communication bandwidth, hardware and software configuration. MPEG-2 (a data rate from 2 MB to 12 MB per second) is used where the size of the bandwidth (10 baseT or greater) is not an issue. This is also true where the user's platform can support either software decoding (CPU intensive) or a custom decoder card. MPEG-1 (a data rate from 64 KB to 2 MB) can be used if ADSL or cable modem bandwidth is available to the end

user. MPEG-4 is used for 56K or lower (to about 33.6K) bandwidth applications. Proprietary streaming systems, such as QuickTime or RealVideo, may also be used in the lower-bandwidth situations, but ISO standards-based systems are preferred. Transcoding latency is an issue that requires careful attention to synchronize the display video and audio with all of the other virtual classroom components.

[0040] A portion of the monitor **96** would be used to display the instructor's desktop. The instructor's desktop, as viewed in section **96**, would include control devices such as a mouse or keyboard, as well as a display screen to be operated by the instructor or, in certain situations, by one of the remotely located students. This area shows to the student an exact duplicate of the instructor's computer desktop in real-time. The instructor's desktop can be used to display static images or real-time moving images thus allowing the instructor to demonstrate software applications, window manipulation, cursor positioning, text entry, and more. At the discretion of the instructor, a student may be able to take control of the instructor's desktop and remotely manipulate the software. However, the default setting would not be shared. Peer-to-peer communication or sharing of the manipulation of the instructor's desktop by more than one student at one time, while possible, it is not a preferred embodiment since this would increase class disruption.

[0041] As described with respect to the instructor's monitor illustrated in **FIG. 3**, the student's monitor **36** would be provided with a question box **98** allowing the student to question the instructor or provide the instructor with a comment. A status line **100** would give the student positive confirmation that the virtual classroom server **24** had received the student's response. Generated by the server software, the status line **100** would display the response and the time that it was received by the server. It is important to note that this does not necessarily mean that the instructor has yet noted the student's response.

[0042] Each of the student workstations would be provided with an input means such as a keyboard **48** as well as a mouse **54**. The keyboard **48** can be provided into two sections **102** and **104**. Section **102** would include a standard typewriter keyboard allowing each student to type in the aforementioned questions or comments directed to the instructor. Section **104** would include a number of response buttons allowing the student to interact with the instructor in an intuitive, rapid manner. As depicted in the monitor of **FIG. 3**, these response buttons or icons could include "yes" or "no" buttons as well as numerical or, as shown in **FIG. 3**, letter buttons (ABCD) allowing the user to answer "yes" or "no" as well as to respond to multiple choice questions. These response buttons can be configured to allow almost any action such as raised hand, fast, slower or help. These responses are displayed by the student name on the instructor's classroom monitor as previously discussed. All responses to "yes" or "no" questions as well as multiple choice questions are logged by the software included in the server **24** to allow grading of quiz questions. Formal testing of the student could also be done using this system but due to security reasons, does not form one of the preferred embodiments. Additionally, these buttons or icons can be displayed on the student's monitor **36**.

[0043] **FIG. 5** illustrates one embodiment of the instructor's desktop unit which is communicated to each student and displayed on their monitor as indicated by section **96**. This desktop unit would include a monitor **106**, a processor **112**, a keyboard **108** as well as a mouse **110**. The mouse **110** and the keyboard **108** would be connected to the processor **112** which is in turn connected to the server **24**. The monitor **106** would be used to display static images or real time moving images as well as allowing the instructor to demonstrate software applications, cursor positioning, text entry, window manipulation and the like. When used to allow a student to take control of the instructor's desktop, a signal would be communicated to the student at which time by use of one or more keys of the student's keyboard **48** or manipulation of the mouse **54**, the instructor's display would then be remotely manipulated by the student.

[0044] The configuration of the virtual classroom is designed to facilitate live student space in a low bandwidth (56K) dial-up environment. Auto sensing software can be implemented to test the user's hardware, software and network conditions and adjust communication speed as required for all portions of the virtual classroom, and allow improvement of the user's experience. The present system would utilize various types of software among one or a plurality of different servers to allow optimization for specific purposes and to enhance throughput and load balancing. UNIX, LINX and WINDOWS platforms with standards-based software (customized or off the shelf) are networked and not clustered to provide maximum performance.

[0045] **FIG. 6** illustrates the process in which a student would gain access to a particular virtual classroom. The user would begin the log in process by entering a particular user name and password. The system would then verify that the student is using the appropriate hardware, software and connectivity bandwidth to participate in the virtual classroom. This step is totally transparent to the student unless errors are detected. If certain errors are detected, an appropriate diagnostic message or error screen would be displayed on the student's monitor to allow the student to take appropriate corrective action to enable classroom participation.

[0046] Additionally, when the system verifies that a valid log in has been accomplished, it would also insure that the student is in the proper virtual classroom and has fulfilled all of the prerequisites required by the educational institution for attendance. This step would also serve to insure that the student is, in fact, the student authorized to participate in the virtual classroom. Secure socket layer (SSL) encryption is used with public/private keys where possible to insure information security. The information submitted when the user logs on is received and processed by an access authorization software provided on the server **24**. No client-side processing is used for security purposes. User information is compared against an access control list generated from an external database. Multiple concurrent log ins with the same user information are prohibited and, if attempted, a security lock out denies access to the virtual classroom. If this occurs, the log in is aborted and a security violation notification is issued to the user's attempting concurrent log ins and a report is generated for investigation by the school administration.

[0047] If the log in is successful, the user would be allowed access to a particular virtual classroom. Previously submitted or concurrently submitted information would

allow the student's virtual classroom workstation to be customized. An example of this would be a large-font scrolling speech-to-text conversion for the hearing impaired or for different forms of interactivity may be incorporated as required. These different forms of inactivity would change the function of the various response buttons as well as the configuration of the various information displayed upon the student's monitor as well as allowing directional audio conferencing. For lecture-only situations, it may be desirable to minimize or even eliminate the student interactivity portions of the virtual classroom to prevent interruptions. Once the user has logged in and the student's workstation has been appropriately customized, the instructor can begin his or her lecture.

[**0048**] The foregoing description of the preferred embodiments of the present invention have been presented for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. Many modifications and variations are possible in light of the above teachings.

What is claimed is:

1. A virtual classroom for allowing an instructor to instruct a plurality of students, each student located at a remote location from all the other students, each student receiving instructional material over a communications network, comprising:

a teaching workstation provided at a location remote from each of the students, said teaching workstation including a first monitor provided with an input device allowing for the projection and manipulation of images on said first monitor;

a plurality of student workstations, each student workstation provided at a remote location from all the other student workstations and the teaching workstation, each student workstation provided with a student monitor for displaying images thereon and an input device for manipulating images displayed on said student monitor as well as for manipulating images projected upon said first monitor;

a camera and microphone provided proximate to said teaching workstation for receiving video and audio material created at said teaching workstation and transmitting said video and audio material over the communications network to each of said student workstations, said video material projected upon each respective student monitor; and

a server connected to said teaching workstation and said camera and said microphone as well as the communications network for controlling the operation of the virtual classroom including managing the flow of signals between said teaching workstation and each of said student workstations over the communications network.

2. The virtual classroom in accordance with claim 1, wherein each of said student workstations receives a video stream of the instructor's presentation to be displayed on a first section of said student monitor and further wherein each of said student workstations receive a video stream of said first monitor to be displayed on a second section of said student monitor.

3. The virtual classroom in accordance with claim 1, said teaching workstation further including a second monitor for projecting information sent from each student to said teaching workstation over the communications network, said information including responses to questions asked by the instructor as well as questions asked by each of the students.

4. The virtual classroom in accordance with claim 2, said teaching workstation further including a second monitor for projecting information sent from each student to said teaching workstation over the communications network, said information including responses to questions asked by the instructor as well as questions asked by each of the students.

5. The virtual classroom in accordance with claim 3, wherein said second monitor includes a status box for indicating time that a question was sent to said teaching workstation from the student.

6. The virtual classroom in accordance with claim 4, wherein said second monitor includes a status box for indicating time that a question was sent to said teaching workstation from the student.

7. The virtual classroom in accordance with claim 3, wherein said server includes a memory for storing information sent to said teacher workstation from each of said student workstations.

8. The virtual classroom in accordance with claim 4, wherein said server includes a memory for storing information sent to said teacher workstation from each of said student workstations.

9. The virtual classroom in accordance with claim 1, wherein said server contains information for customizing each of said student workstations.

10. The virtual classroom in accordance with claim 3, further including a camera provided at each of said student workstations for transmitting video information from said student workstation to be projected upon said second monitor.

11. The virtual classroom in accordance with claim 1, further including a microphone provided at each of said student workstations for transmitting audio information from said student workstation to said teaching workstation.

12. The virtual classroom in accordance with claim 11, further including a speaker provided and said teaching workstation for broadcasting said audio information.

13. A virtual classroom for allowing an instructor to instruct a plurality of students, each student located at a remote location from all other students, each student receiving instructional material over a communications network, comprising:

a teaching workstation provided at a location remote from each of the students, said teaching workstation provided with a first monitor for projecting information sent from each student to the teaching workstation;

a plurality of student workstations, each student workstation provided at a remote location from all the other student workstations, each student workstation provided with a student monitor for displaying images thereon and an input device for manipulating images displayed on said student monitor as well as sending information to said teaching workstation over the communications network to be displayed on said first monitor;

a camera and microphone provided proximate to said teaching workstation for receiving video and audio

material created at said teaching workstation and transmitting said video and audio material over the communications network to each of said student workstations, said video material projected upon each respective student monitor; and

a server connected to said teaching workstation and said camera and said microphone as well as the communications network for controlling the operation of the virtual classroom including managing the flow of signals between said teaching workstation and each of said student workstations over the communications network.

14. The virtual classroom in accordance with claim 13, wherein said server includes a memory for storing information sent to said teaching workstation from each of said student workstation.

15. The virtual classroom in accordance with claim 13, wherein said server contains information for customizing each of said student workstations.

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