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Lee

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(54) **LIGHTING CONTROL SYSTEM WITH WIRELESS NETWORK CONNECTION**

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Related U.S. Application Data

(63) Continuation of application No. 11/748,996, filed on May 15, 2007, now Pat. No. 7,748,878.

(60) Provisional application No. 60/801,252, filed on May 18, 2006.

(51) **Int. Cl.**
B60Q 1/06 (2006.01)
(52) **U.S. Cl.** **362/386**; 362/233; 362/85; 362/281; 315/291

(58) **Field of Classification Search** 362/85, 362/283, 281, 386; 315/291, 312, 294; 700/19
See application file for complete search history.

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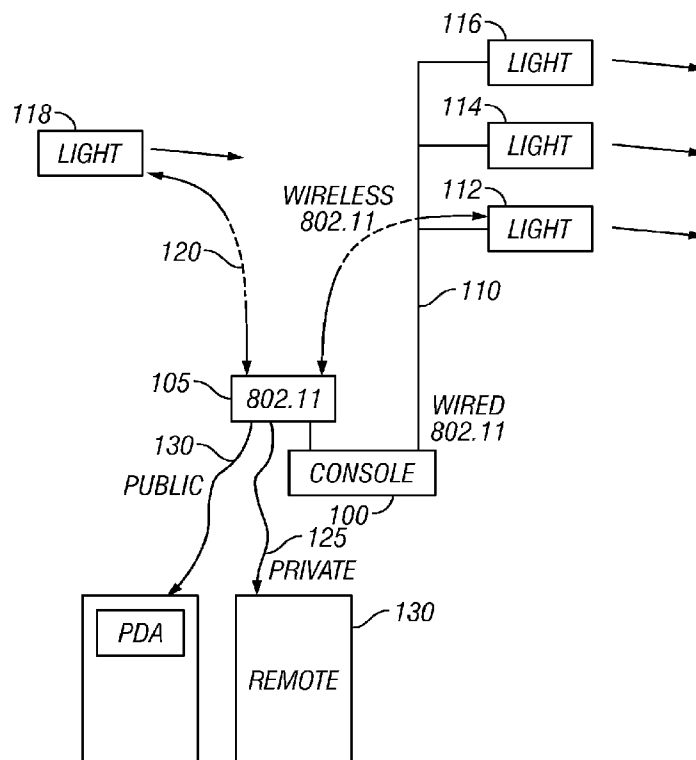|				
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(57) **ABSTRACT**

Wireless network used to control multiple lights, includes multiple different networks for different purposes, and interference prevention mechanisms.
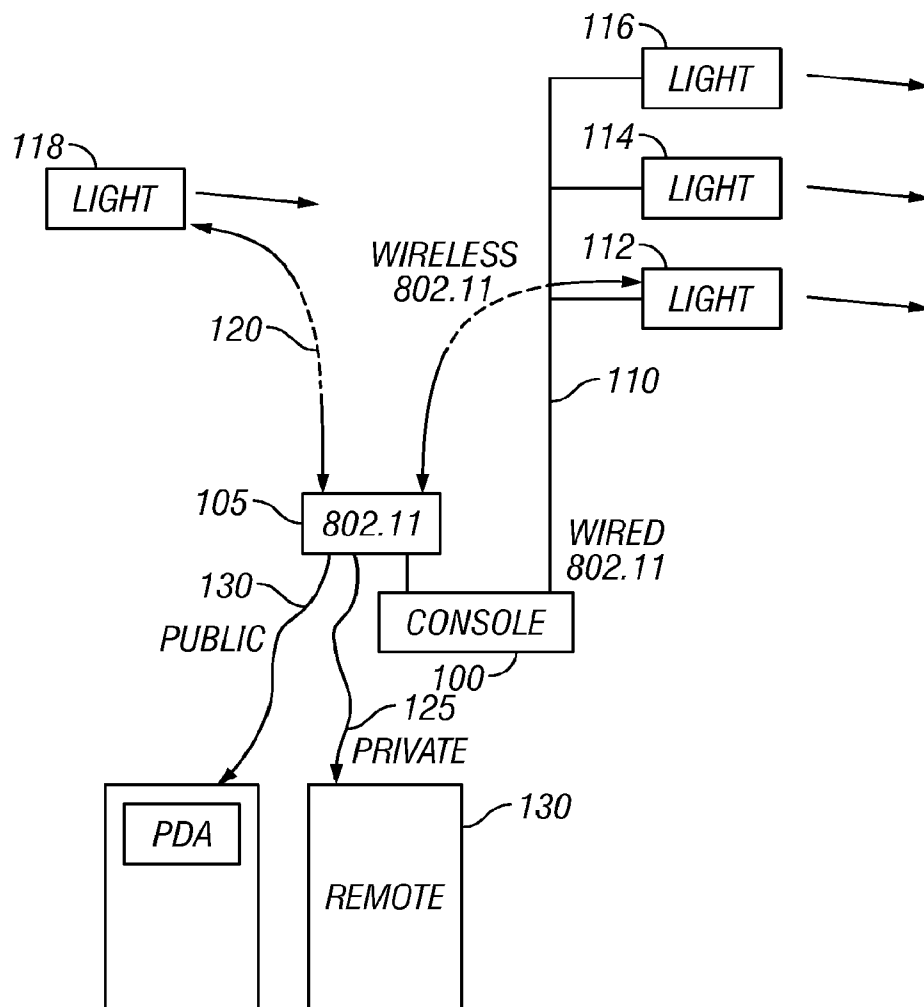
16 Claims, 1 Drawing Sheet

116 — LIGHT →

118 — LIGHT →

114 — LIGHT →

*WIRELESS
802.11*

112 — LIGHT →

120

105 — 802.11

110

130 — PUBLIC

*WIRED
802.11*

CONSOLE

100

125

PRIVATE

PDA

REMOTE — 130

FIG. 1

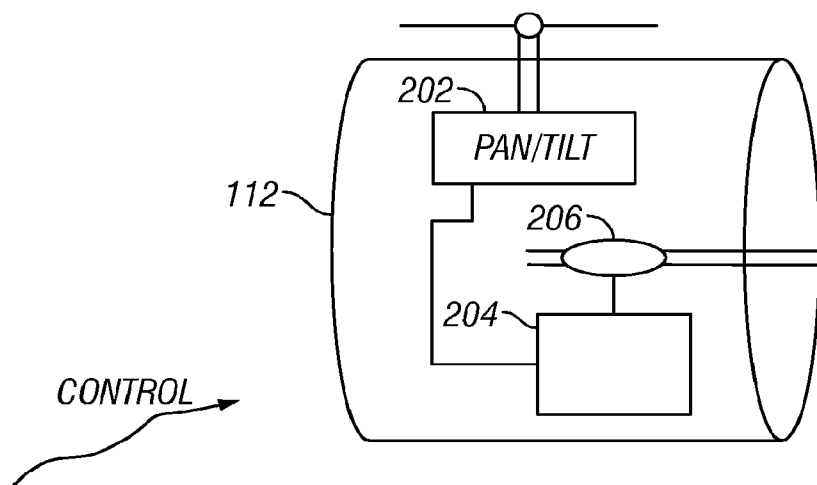202 — PAN/TILT

112

206

204

CONTROL →

FIG. 2

LIGHTING CONTROL SYSTEM WITH WIRELESS NETWORK CONNECTION

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to U.S. Provisional Application 60/801,252, filed May 18, 2006. The disclosure of the prior application is considered part of (and is incorporated by reference in) the disclosure of this application.

BACKGROUND

Stage lighting control systems are known, and/or described, for example, in various patents owned by Production Resource Group L.L.C. Many of these patents describe a central console being used to create commands for a number of lights collectively forming a lighting effect or lighting show. Each of the lights, for example, may be capable of projecting a light beam of 100-200 W or more, may be capable of light beam movement in pan and/or tilt directions, and light beam shaping, done by a gobo.

The connection to the lights is typically done over wires, for example using DMX, or using the so-called Arcnet protocol which provides DMX over ethernet. It has been suggested that control of lights using commands sent directly over wired ethernet may also be carried out.

SUMMARY

The present application describes wireless control of lights in a stage lighting scenario.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other aspects will now be described in detail with reference to the accompanying drawings wherein:

FIG. 1 shows a system diagram showing the console connected to control a number of lights; and

FIG. 2 illustrates a light and wireless control.

DETAILED DESCRIPTION

The general structure and techniques, and more specific embodiments which can be used to effect different ways of carrying out the more general goals are described herein.

An embodiment is shown in FIG. 1. A lighting control console 100, which may be the PRG Virtuoso console, or may be any other console which is capable of controlling multiple remote lights.

A first connection 110 is a conventional wired connection which may connect to a number of conventional lights such as 112, 114. These conventional lights may be of a type which are only controllable via wired connections. Virtually every stage light today available is controllable in this way.

Light 112 is capable of receiving both wired connections and wireless connections. The console 100 has a wireless communication module 105 which enables connection to wireless-enabled lights such as 112.

An exemplary light 112 shown in FIG. 2 has a pan and tilt motor 202, a controller 204, and a lamp 206.

Light 118, also controlled by console 100, has a connection only via the wireless connection shown as 120.

Any of the lights 112, 114, 116, however, may be stage light type devices, that is may be remotely controllable to change their pan and tilt orientation, and thereby change the position at which the light is directed. The light may be

mountable on a truss or other supporting device, and may preferably project a light beam having an intensity of at least 100 W. In addition, the light can be provided with a built-in functionality for wireless control, or may have an add-in functionality for such wireless control.

In an embodiment, the wireless device 105 may also produce two additional wireless streams. The wireless stream 125 is a private stream. The private stream 125 enables administrative functions to be carried out either on the console, or on the controlled lights.

For example, a remote 130 can connect to the private stream. The remote 130, for example, can enable a lighting designer or other operator who is operating using a laptop or tablet style computer to carry out functions on the console or the lamps. The remote may be a dedicated laptop that runs a light version of the software on the console, and accepts commands either over the keyboard, or through the mouse or other GUI based commands.

Alternatively, the remote may control using a web browser style interface, produced by the console 100, and routed to the private network 125. The web browser can run based on console software, thereby automatically updating that software whenever the main console software is updated.

A public wireless connection 130 may also be provided. The public wireless connection may be itself controlled by the console. For example, while the console controls lighting effects by the lights 112, 114, 116, 118, it has the ability to control many different lights. The public connection 130 may be intended to control yet another "light"; however this "light" can be any mobile phone, PDA or other unit that is in range of the wireless connection. In this way, the lighting designer is able to stream video and/or other show media and lighting information to the holder of the PDA.

Any PDA with 802.11 wireless capability, or other data capability such as cellular, Bluetooth or other, may also receive the lighting information. The public stream 130 may alternatively be conveyed over other formats, such as Bluetooth.

This forms three different streams of information which are sent from the console: the controlling information to the lights, the status information to a remote, and the public information. The public information may be transmitted with virtually no security, since it is intended to be received by any user in the vicinity of the information.

However, the private line 125 and the control lines 120 should be secured. The private line should be secured against hackers, since otherwise anyone with knowledge of the system could hack in and change the show or change other parameters. For example, this security may use any of the encryption protocols which are associated with the wireless networking, and preferably uses the strongest possible encryption.

However, the control protocols require not only protection against hacking, but also protection against interference. During the shows, many electronic devices are operating. Many users may have cell phones, and many persons in the audience may also have cell phones. Cell phones, and especially GSM cell phones, may cause interference. In addition, there are moving motors and other items which may cause interference. Accordingly, the stream 120 may be interference protected. This may be done by using a spread spectrum form of 802.11, for example, or by using an extremely error corrected form of 802.11. In the most extreme case, each command may be sent four or five times, and the light is instructed to respond to a command only when the command is properly received multiple times in a row.

According to another embodiment, the commands may be sent along with a hash value indicative of the commands, so that the light may compare the command with the hash value to ensure that the command was properly received. The light may send an acknowledgment when the command and hash are properly received. Otherwise, the command is eventually re-sent.

Some lights, such as **114**, are legacy devices, and will not be controllable over the wireless control. Other lights, however, such as **112**, will be controlled both via wired and wireless. These two different networks may form additional levels of communication for the light, and may enable other things.

Another aspect allows using any of the network connections described herein to forward digital content (which could include video content) wirelessly, using the techniques described herein.

The general structure and techniques, and more specific embodiments which can be used to effect different ways of carrying out the more general goals are described herein.

Although only a few embodiments have been disclosed in detail above, other embodiments are possible and the inventor intends these to be encompassed within this specification. The specification describes specific examples to accomplish a more general goal that may be accomplished in another way. This disclosure is intended to be exemplary, and the claims are intended to cover any modification or alternative which might be predictable to a person having ordinary skill in the art. For example, other wireless networking protocols are contemplated, including Wimax, Zigbee, and others.

Also, the inventor(s) intend that only those claims which use the words "means for" are intended to be interpreted under 35 USC 112, sixth paragraph. Moreover, no limitations from the specification are intended to be read into any claims, unless those limitations are expressly included in the claims.

The consoles and computers described herein may be any kind of computer, either general purpose, or some specific purpose computer such as a workstation. The computer may be an Intel (e.g., Pentium or Core 2 duo) or AMD based computer, running Windows XP or Linux, or may be a Macintosh computer. The computer may also be a handheld computer, such as a PDA, cellphone, or laptop.

The programs may be written in C or Python, or Java, Brew or any other programming language. The programs may be resident on a storage medium, e.g., magnetic or optical, e.g. the computer hard drive, a removable disk or media such as a memory stick or SD media, wired or wireless network based or Bluetooth based Network Attached Storage (NAS), or other removable medium. The programs may also be run over a network, for example, with a server or other machine sending signals to the local machine, which allows the local machine to carry out the operations described herein.

Where a specific numerical value is mentioned herein, it should be considered that the value may be increased or decreased by 20%, while still staying within the teachings of the present application, unless some different range is specifically mentioned. Where a specified logical sense is used, the opposite logical sense is also intended to be encompassed.

What is claimed is:

1. A stage lighting console, comprising:
a console device, having a processor;
a storage part that stores a program that controls a moving light of the type having a controllable motor, that allows moving the light in at least pan and tilt directions, wherein executing said program on said processor of said console device produces effects on said moving light and moves a position of said moving light,

said console also producing an output based on said executing said program, said outputs sent to a plurality of different moving lights via a wireless network connection, and said program and said connection also producing an output based on said program that produces effects at different times,
said console wirelessly sending at least some of said effects being sent both to said moving lights, and also sent wirelessly sending at least some of said effect to plural different computing devices other than said moving lights which are within range of the wireless network and which are not part of the specific moving lights that are controlled by the program.

2. A console as in claim **1**, wherein said control to said moving lights via said wireless network is sent over a channel having security, and said control to said different computing devices is sent over a channel which does not have said security.

3. A console as in claim **1**, wherein said program controls effects that are carried out by a plurality of different moving lights, and also controls effects on client computers associated with clients in an audience.

4. A console as in claim **3**, wherein said client computers include cell phones and PDAs.

5. A console as in claim **1** wherein said program accepts commands for the moving lights from a client computer remote from said console, over a secured network connection.

6. A console as in claim **1**, wherein said console controls a first wireless stream for commanding the lights, said first wireless stream having a first security, and said console controls a second wireless stream for commanding functions of the console, said second wireless stream having a second security, and said console controls a third wireless stream for communicating to client computers within range of the console, said third wireless stream not having said first security or said second security.

7. A console as in claim **1**, wherein said program sends status information about the program and/or the moving lights to a client computer, over a secured network connection.

8. A method of controlling a lighting show, comprising:
producing first outputs from a controlling console that control a movement in at least pan and tilt directions of multiple different moving stage lights which form part of a show, and which lights were programmed into said controlling console, and said outputs also controlling effects created by said multiple different moving stage lights at different times;
sending said first outputs from said controlling console wirelessly to said multiple different moving stage lights;
producing second outputs indicative of effects at said different times for computing devices other than said moving lights, said devices other than said moving lights not being lights that are programmed into the console; and
sending said second outputs wirelessly to devices within range of a wireless network.

9. A method as in claim **8**, further comprising sending said first outputs over a channel having wireless security, and sending said second outputs over a channel which does not have said wireless security.

10. A method as in claim **8**, wherein said controlling console runs a program that controls effects by a plurality of different moving lights, and also controls and effects on client computers that are held by clients in an audience.

11. A method as in claim **10**, wherein said client computers include cell phones and PDAs.

12. A method as in claim **8**, wherein said controlling console accepts commands for the moving lights from a client computer, over a secured network connection.

13. A method as in claim **8**, further comprising creating a first wireless stream for commanding the lights having a first security, creating a second wireless stream for commanding the console, having a second security, and creating a third wireless stream for communicating to client computers within range of the console.

14. A method as in claim **10**, wherein said program causes sending of status information about the program and/or the moving lights to a client computer, over a secured network connection.

15. A method of controlling a lighting show, comprising:

producing first outputs from a controlling console that control an effect created by multiple different moving stage lights which form part of a show; and

producing second outputs from said controlling console that control an effect created on cell phones and PDAs within range of said show as part of said show.

16. A method as in claim **15**, wherein said first outputs have wireless security, and said second outputs do not have said wireless security.

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