LightCon

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A system to integrate music with a light show, LightCon

Centralized control of lighting is a technology employed everyday. Two primary places have been building controls and entertainment. From a centralized lighting console, usually called a light board, play houses and concert venues control the lights used to entertain their guests. To a lesser extent, consoles have been used in night clubs. LightCon is a software to exceed the usual notion of a light console. This software will not only replace the functions of a light console but allow the processing of audio to create a live computer generated light show. In addition the program will control specialized lasers that are used to project video images. With the use of a general purpose personal computer and specialized hardware interfaces LightCon will scale and be customized to any particular application.

Illustration 1: Typical light board console example. Source: http://www.zzounds.com/item--BEHLC2412
Hardware Interfaces

LightCon will fit into existing, industry standard, DMX-512A systems. This is a mandatory requirement for market acceptance. A personal computer will use specialized hardware to connect with existing DMX networks. Internally the device will be a PCI card that contains a DMX controller and other necessary hardware. It connects to a dongle which has 5-pin XLR or 3-pin XLR ports.

To exceed existing designs a second and third card are used. The second card is another PCI card connected to a dongle. This dongle will allow multiple channels of audio input. Typically this input will be from the existing sound mixing board, with the flexibility to accept input from a Blu-Ray or DVD player. The third card will use the same PCI slot and dongle style, this will control a laser or set of lasers to display video and its playback.

To control all the hardware the user interface will have three basic elements: hardware setup, scene control and performance. Hardware setup will be a primarily automatic setup. A lighting operator may choose to override or customize his or her hardware parameters or simply verify that existing hardware is properly recognized. The second menu will be fairly complex with sub-menus for specific tasks. The functions it will include are scene control presets, cues, timings, light parameters,
and channel assignments. Additionally DMX can control non-lighting hardware button assignments will be set here. To ease the transition to the new user interface the performance interface will provide visual elements on multiple touch screens that are like existing consoles. These elements are buttons, switches, faders, and dials. The touch screens would be of wide screen format.

Illustration 3: An example setup drawing.
DMX-512A Overview

DMX-512A is a digital lighting control system that has been in existence for 20 years. Over this time it has become an industry standard and universally adopted by . The American National Standards Institute codified DMX in 1990. This system defines 512 channels in a single lighting universe. Each channel sends a single byte to a device. Devices are daisy chained using 5-PIN XLR cabling.


Pin assignment:
1. Data Link Common
2. Data 1- (Primary Data Link)
3. Data 1+ (Primary Data Link)
4. Data 2- (Secondary Data Link)
5. Data 2+ (Secondary Data Link)
Source: http://en.wikipedia.org/wiki/DMX512-A

There is no limit to the count of channels a device may use. The only limit of the device that can be controlled is defined by the standard is any device that controls something that risks human safety. Some common non-lighting devices controlled via DMS are fog and confetti machines.

The lights that can be controlled can vary greatly. A Parcan is a simple form of lighting. They typically use a single DMX channel to control brightness. They are focused on a particular section of a stage and are optionally colored. Club and DJ lighting tends to be more complex. This is the kind of device that will use multiple channels. Each channel can control a different aspect of this type of light. For example one channel will control the color, another controls the pattern of the light, another controls the direction, and another can control the brightness. Imagination is really the only limit.

Manual control of the lights has been the typical setup of most lighting consoles. This is something LightCon will expand on. The audio input will allow the use of signal transforms to control the lights. Some common transforms used in signal processing is Laplace and Fourier. Not only via signal transforms but a time based cues can be used for LightCon or manually generated cues. In addition to DMX light control. Laser controls will also be possible. Laser effects create very appealing visual effects.
File Format

In order to save performance configurations a specific file format will be used. This performance file will contain a listing of all light models used, channel assignments, cues, and scenes.

The file format will follow standard XML. An example of a performance file:

```xml
<light_performance>
  <light_arrangement>
    <light type="" start_channel="" id="">
      <parameter type="" value=""/>
    </light>
    ...
  </light_arrangement>
  <scene>
    <program id="" light_id="">
      <setting key="" value=""/>
    </program>
    ...
  </scene>
  <program id="">
    <time offset="" cue_id=""/>
    ...
  </program>
  <switch_set id="">
    <tie channel="" min="" max="" taper=""/>
    ...
  </switch_set>
</light_performance>
```
Class Diagram of the Model

Illustration 6: Model Class Diagram
Additional Information

DMX

- http://dmx512.com/index.htm
- http://www.dmx512-online.com/