Yale School of Engineering & Appied Science

Becton Engineering Café & Lobby

LED Wall Control System White Paper
September 11, 2012

Overview:

The purpose of this white paper is to share an understanding of the control system of Yale's Becton Engineering Café and Lobby LED Wall. This paper augments the system description and user interface provided in an earlier white paper (entitled *Yale Becton Cafe LED Wall Control*, dated August 13, 2012) and highlights the physical and programming interfaces needed to access and control the system[1].

The system consists of two LED installations (one in the café and the second in the lobby), the Philips/Color Kinetics Video System Manager Pro (VSM) which includes the Video System Engine Pro (VSE Pro) controller interface and Video Management Tool (VMT) software, the Hippo Critter media server which uses ZooKeeper as the interface software and Hippo-Engine as the control software, the Pharos Light Controller, and a Crestron operating system.

The role of each of these systems will be detailed from the viewpoint of the five user modes identified in the previous white paper:

- System Administrator Control
- Tour Guide Display Mode
- "My Computer Display" Use
- "My Work/Your Media Server" Use
- "My Creation" Use (for advanced LED lighting programmers)

Specific connection interface and system requirements, as well as significant project milestones, are highlighted throughout the document. Corrections to this document are invited and welcomed.

LED System Mapping:

Both installations (the café and the lobby) will be mapped as a composite unit on a standard 1024 x 768 grid with a split video frame. This mapping will be accomplished by Philips/Color Kinetics. The Hippo Critter's layer function will be used to make the café one video layer and the lobby a second video layer, thereby allowing independent control of each segment of the installation. A third video layer will be used (if needed) to treat both the lobby and the café as a connected and contiguous installation (thereby not splitting the video screen into two separate regions).

It is envisioned that a quick map can be established during system testing at SignLite on SEP 14 and the system's final map can be established at Yale after the system is installed[2].

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[1] These notes reflect a meeting between Yale (V. Wilczynski/S. Geringer) and Philips/Color Kinetics (A. Urban) held at Yale on September 7, 2012 as well as input from HB Communications, Inc. (via email correspondence with Brian Metcalf).

[2] Though independent of control, the discussion of the mapping process included a review of the procedure for replacing defective LED nodes. Single LED nodes can be replaced on-site provided access is available to the back of the panels. The node would need to be removed from its panel followed by the removal of the power/data cable on each side of the node. A new node, which would include interface adapters, would then be inserted into that string of LEDs. In the event the failure would be an entire string, that string would be removed in its entirety and then replaced.

Equipment Layout:

A final riser diagram for the system remains to be developed, shared and approved by all parties.

Enclosed in this document are three aspects of what will develop as the final riser diagram:

- A preliminary system riser diagram created by Philips/Color Kinetics (as submitted by Justin Rawlings (P/CK) in a July 26, 2012 email)
- A detail of the café control system located in an aluminum pilaster within the café (as submitted by Rich Charney (Charney Architects) in a August 28, 2012 email)
- An AV Floor Plan (that includes a separate audio system) created by HB Communications (as submitted by Brian Metcalf in a September 4, 2012 email).

These documents, combined with the additions noted in this white paper, should be combined into a final riser diagram so that all parties can have a single set of drawings to confirm communication connections and access features of the café.

It is envisioned that all equipment be located in the remote Equipment Space (outside the café and accessible via a pull down staircase) with the exception of the Crestron system and the connection interfaces (identified in this document) that would be mounted/accessible in the café.

An *LED Lighting System LAN* that is independent of the Yale LAN needs to be established and installed for this installation to link all components of the system. To protect the integrity of the system, this LAN must be independent of the Yale LAN. The Pharos Light Controller requires a VPN connection which will be detailed in the section labeled Pharos Lighting Controller System Integration.

Interfaces for Each Operating Mode

This section details the specific interfaces needed for each of the five user modes for this system.

- **System Administrator Control and "My Work/Your Media Server" Use Modes:**

These two operating modes require access via Ethernet to the Hippo Critter to load and manipulate content as well as establish projection playlists. For this installation, an *LED Lighting System Laptop* will be purchased and connected to the Hippo Critter via the *LED Lighting System LAN*. The café installation must include an isolated Lighting System LAN connection for this purpose.

The *LED Lighting System Laptop* will be configured with the ZooKeeper interface software as well as with virus detection software[3].. The laptop will be set up such that any flash drive that is inserted into it is automatically scanned for viruses. This is essential as this laptop will serve as the single source for loading content on the HippoCritter media server. Using the Ethernet connection, the laptop will act as the slave to the HippoCritter which will serve as the master controller.

This configuration will allowed trusted users to operate this laptop to load content, establish playlists of content and to manipulate content using the HippoCritter's operating system. The laptop will be issued to trusted users and then returned to the System Administrator.

System Administrator Control will also use the *LED Lighting System Laptop* to access and control the installation. In addition to access to the HippoCritter, the System Administrator Control will also have access via a VPN to the Pharos Lighting Controller to remotely shut down the system. Additional details on the interface for this function is provided in the section labeled Pharos Lighting Controller.

[3] This laptop will be acquired, configured and controlled by the Yale School of Engineering & Applied Science (Steve Gerringer).

Since the System Administrator Control or "My Work/Your Media Server" Use modes will connect directly to the HippoCritter, one button on the Crestron interface should be reserved to display content provided by either of these users. This button will play the pre-loaded playlist on the HippoCritter when new content is not being uploaded or manipulated. Also, the pre-loaded playlist should be the default setting for the Crestron system.

- **Tour Guide Display Mode:**

In this mode the system operator is a tour guide who is leading a tour of prospective Yale Engineering applicants and parents on a campus tour. In this mode of operation the tour guide would bring a group of visitors into the space to talk about the installation and then pull up four examples of content (three static images and one video). It is envisioned that buttons on the Crestron system would be used to toggle a scene selection sequence. After a period (perhaps five minutes) of no-activity from the Crestron system, the default mode would then initiate to project the playlist as established by the System Administrator.

- **"My Computer Display" Use Mode:**

In this mode any laptop, iPad, or digital camera or other image producing device would be used as a system input via a VGA or HDMI connection between the supplied unit and the Crestron system. The Crestron system would convert the input display into a 1024 x 768 format and transmit that data to the VSE using a DVI connection. With a selection of a button the Crestron, the video switch attached to the VSE would be triggered to send this video directly to the VSE for display on the café LED screen.

For the image to be displayed the user's input device must reside in the space and be connected to the Crestron system. The Crestron system should be programmed to automatically return to the playlist established by the System Administrator once the input device is disconnected from the system (to ensure that the LED display remain active once the input signal is disconnected). It is noted that these users will have the option of submitting their work to the System Administrator to be entered into the standard playlist of images.

- **"My Creation" Use Mode:**

In this mode the user would directly access the Philips/Color Kinetics sPDS-480ca intelligent, power/data supplies using proprietary software protocols. This use would only be accomplished with the appropriate non-disclosure agreements approved by Philips/Color Kinetics. Access to the power/data supplies would be provided using the Lighting System LAN.

Pharos Lighting Controller System Integration:

The Pharos Lighting Controller, while very powerful in its own right, will be used as a triggering device and as a remote shutdown device for the system. The Pharos Lighting Controller should be mounted in the Equipment Space on the rack with the HippoCritter and connected to the HippoCritter via an RS-232 connection. It is noted that the HippoCritter has a single RS-232 connection, thereby necessitating that an interface be included in the system layout to allow multiple RS-232 connections to the HippoCritter.

The Pharos Lighting Controller can be powered using Power-Over-Ethernet (or alternatively by a separate 9-48 V DC Power Supply, but only one means of input power can be used). This Ethernet connection would incorporate this unit as part of the Lighting System LAN. In addition, a wireless router should be included on the Phillips/Color Kinetics switch to allow a VPN connection to the Pharos Lighting Controller. This VPN access point will allow the System Administrator to remotely access the system to

issue an "all lights out" command from the Pharos in the event that the system is high jacked and used to display inappropriate content.

In addition to this function, the 8 analog/digital channels of the Pharos will be used as input signals by advanced users to trigger responses on the LED screen. For example, the display may be programmed to respond to sound, temperature or movement. As such these 8 dual –wire connection points must be pulled out into the café **and the lobby**. They may remain hidden within the pilaster or behind a plate to be used at some point in the future[4]. Also the Crestron system must be programmed to allow a button sequence to be used to allow the Pharos Lighting Controller to provide triggering information to the Hippo Critter. This button sequence can be more complicated than the previously identified modes, as only advanced users would be adding the Pharos Lighting Controller capabilities to the system's overall control functions[5]..

Video and Audio Switching:

The VSE is the component that interfaces with the power supplies for the LED lights. A video switch is needed in the system (activated by the Crestron) to select video signals that are either input directly (via DVI) from the Crestron (when in the "My Computer Display" Use mode) or input from the HippoCritter (when in all other operational modes). The position of the video switch should be established by the specific Crestron buttons mapped to each mode of operation.

Audio switching is needed to allow the audio signal to be input via the attached laptop (via Ethernet to the HippoCritter for processing) or via the video input device (in the "My Computer Display" mode). The audio input on the HippoCritter uses a 1/8" audio jack and access to this connection must be available at the café control station pilaster. It is recommended (by Philips/Color Kinetics) that an external USB audio interface be used to convert the audio signal to a digital format at the input source to protect the integrity of the audio signal.

Crestron/HippoCritter Communication Interface:

Communication between the Crestron and the HippoCiritter is accomplished via a dedicated RS232 connection between both units. Display commands (such as for brightness for example) are detailed at the Hippo Critter web site[6]:
http://www.green-hippo.com/support/index.php?/Knowledgebase/Article/View/137/0/rs232-instructions

Providing for Additional Conduit Runs:

Additional conduit runs between the remote Equipment Space and the café Control Station should be included in the installation to allow for future enhancements of the system.

[4] The 8 inputs are indicated on the system profile presented at http://www.pharoscontrols.com/products/lighting_controllers/lpc

[5] This feature should be tested during the system installation by using a simple limit switch to close the signal on one of the Pharos Lighting Controller's inputs to trigger a specific behavior (such as turning off all lights) on the LED wall.

[6] Adam Urban will provide Brian Metcalf with details on accessing the correct site is not correct.