**The 2018 Custom House Project**

**What were the performance objectives for this design criteria?**

The highest reliability, safety, and security were the primary goals. Ease of use was another important concern. Having programmed lighting, as well as A/V with manual, one-button touch, was paramount. The client wanted an end-to-end 18 gig. video distribution system. This included 4K HDR-TVs, a 4K camera system, and an 18 gig. matrix feeding fiber optic 18 gigabyte cables. Distributed audio required custom-length *Toslink* return cables from the televisions. Smart TV and over-air broadcasts are played on either surround sound or house sound systems. For optimum efficiency, announcement and house amplifiers are Class “D.” All of the control room electronics, except for subwoofer amp. and Onkyo receiver, are on a double-conversion UPS, which is currently powering at approximately 50% load. A comprehensive surge protection solution was specified for the main circuit breaker panel; the pool panel; all A/C handlers and water heaters; and the televisions. Category 6 cabling and gigabit networking equipment with remote management was specified, including sequenced and timed startup of devices. Also specified was voice control integration for the Amazon Echo and Dot (Alexa). Individual wires were run to achieve individually-named zones for doors, windows, and all other sensors. There are also many empty conduit pathways installed in the walls and ceilings to allow for future upgrades. Aesthetic integration of the systems into the home’s decor was necessary, so the various sensors are either hidden in the home's framework, or, if visible, painted to be camouflaged. Cables and cable boots, Heatshrink, Velcro strapping, and labels are all color coordinated. The trim-out is artistic.

**List and discuss all integrated subsystems in this project. (AV, HVAC, lighting, security, networking, etc.)**

Whole house surge suppression was installed. The ground conductors are cad-welded to the ground rods for enhanced connectivity and surge protection performance. Lightning protection, which is not connected to electrical ground, was installed by others.

In addition to *Omni Pro II,* a *Control4* controller was added both for luxurious doorbell sounds, and additional vocabulary not available with the Omni system.

All A/V Electronics are controlled by *Leviton Bitwise* software. To keep costs down, IR flashers are series-connected to double up on devices so only one controller was necessary. *Bitwise* was deeply integrated with *Omni* automation and *Leviton* HiFi audio system.

There are eight distributed audio zones and one surround sound zone. The surround sound employs Stealth Acoustics hidden speakers; the center channel is above the TV, and the subwoofers are installed in the walls. Broadcast RF signals from an outdoor antenna are routed to all television tuners as back-up during a power outage. Four-5 megapixel HDR cameras and two-1080p PTZ cameras were installed with 4K output to the HDMI matrix. All cameras can be viewed on all TVs, and controlled by *Bitwise*.

***Security integration*** There are motion sensors facing entry areas, in corridors; flex sensors under steps illuminate the stairwell. The garage roll-up doors are sensed and controlled. Also, there are sensors to monitor the refrigerators and freezers for failure. A *Z-wave* door lock was installed and integrated. Driveway, front porch, and doorbell sensors “alert” the residents to visitors. All bare circuit boards are interconnected at two *OnQ* panels located in the control room; wires from contacts, sensors, and other devices are color-coded and organized at these panels. Security system sensor wires are individually run to achieve individual names for doors, windows, and all other sensors.

Temperature of refrigerators, freezers, control and wine rooms, as well as outdoor temperature/humidity is monitored. The *Omni Pro-II* also monitors three alarm outputs from camera/DVR as motion detection integration. Alarm loop wires are used to monitor tampering of outdoor TVs, and septic float power failure. Email and text notifications are sent for various events i.e. alarm, fire, failures, etc. ***Lighting*** Twenty-eight circuits, front fountain, and landscape lighting are included in the integration of the Master house scenes. The motion sensors in halls trigger lighted pathways; flex sensors under steps trip the light in the stairwell “On” for 2 minutes. Top landing lights are triggered by upstairs motion. The driveway sensor turns on flood lights when arriving, if the alarm is set for “Away.” Continuing on in, the opening garage door turns on the garage hall light when entering. ***Network*** This network is a standard gigabit, with a WAP installed above the garage, and powered by a double conversion UPS. The Most critical components are directly attached to the routers 4 ports and are as follows, Omni, Bitwise, Camera DVR. This was done to provide more reliability (if the switch goes down these components are still connected to reduced, limited network).

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| **List all automation events that happen within and between the integrated subsystems.** | |
| Both arming to “Away,” or a single button shuts down all electronics and lighting*. OmniPro II*  monitors the alarm outputs on the camera/DVR to trigger announcements i.e.“Driveway Active;” “ Pool Activity;” “ Front Porch Active;” which also can be turned on or off individually. If, when armed to “Away” or “Vacation,” the camera detects motion, it announces on the back porch speaker, “YOU HAVE BEEN DETECTED. LEAVE IMMEDIATELY.” Also, on burglary and fire alarms, *OmniPro II* announces the violated zones. There are four separate voice sets that can be turned on or off, as needed. First voice set initiates the *Control 4* voices, which are: “Driveway Active,” “Doorbell,” and “(X) Door Left Open.” *C4* starts a timer on any opened door for 90 seconds. If the timer expires and the door is still open, it says, “(X) Door Left Open.” The second voice set is the pool alert. The third is the child safety gates voice set, which alerts when top or bottom stair gate is opened. The last voice set is, “Front Porch Active.” The intruder alert only operates when there is no one home.  *Omni* handles lighting at scheduled times; it turns on floodlights for driveway activity detection.  Opening the garage door turns on the garage hall light if system is armed. Also when armed, tripping back/front porch motion detectors activate lighting in those areas. Top and bottom step sensors turn the stairwell light on for two minutes. Top landing lights are triggered by upstairs motion sensor. Front porch and doorbell sensors also turn on lights when tripped. On burglary and fire alarms, all lights come on and front porch light blinks for emergency response.    Both PTZ’s have seven preset locations. When “Driveway active” is triggered, the driveway  PTZ changes to the driveway view. A burglary or fire alarm triggers “Watch cameras” com-  mand on all TVs. Arming security system turns off all A/V in the house.  Lighting scenes programming changes according to security system status. An “at home”  scene is programmed for *vacation*, while other sets of lights are on/off for *away*. When  arriving, lighting features begin with the driveway sensor triggering the outdoor floodlights.  *Bitwise* is set up for “Select a Room” control. This page has an “All Systems Off” button. There  is a sync page for both audio and video, which is available on cell phones and tablets. | |
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***Discuss your accomplishments integrating and automating this project***

Safety was the primary objective, with **ease of use** being the second directive. Having A/V with one-button touch was paramount. The residence was integrated using industrial methods: cad-welding ground rod; advanced surge suppression; fiber optic signal distribution; open conduit for future; A/V sync pages; tight security and camera integration. Employed also are: end-to-end 18 gig. video distribution; advanced announcements; child safety enhancements; *Amazon echo* integration. There are three applications programmed for multiple device use: *Leviton Snaplink* mobile; *Leviton Bitwise;* and a camera application.

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| All the televisions were calibrated through the HDMI matrix using *Sencore* , *VP 403*, and  *Color Pro* gear. The client chose not to have an audio calibration, as the equipment has no  equalization, just treble and bass controls. However, we did adjust all audio controls to his  preferences.  There is 8’ of “slack” (stored in the cable duct) for each cable coming into the control room,  which is finished with artistic and efficient cable organization.  **Share all technical details and/or calculations made concerning the main power**  **management for this home.** |
| No calculations were made by integrator except the load on the double conversion UPS  The electrician did not provide any information or calculations.  Omni=50 Watts  Camera DVR=20 Watts  Cable DVR = 35Watts  Cable box 2 =25 Watts  Cable box 3 =25 Watts  Cable box 3 =25 Watts  Camera power supplies =110 Watts  Leviton Hi Fi =130Watts  HDMI Matrix =38 Watts  Bitwise controller=8 watts  Audio converters = 12 Watts  Wattbox= 20 Watts  Control4 HC250 = 25watts  PoE switch =60 Watts  OVRC = 10 Watts  Total Watts 593/.9 power factor =658 V/A  1000 V/A-658=leaves 342 V/A Overhead on UPS  UPS shows 50% power load on Display Panel, so the actual current consumption is  less than the calculations. |

**Explain any compromises made from CEDIA and/or industry standards and why those compromises were needed.** The client chose to not pay for advanced documentation, schematics, block diagrams, room layouts, or professional audio calibration. Yet, we provided as much as possible, ourselves. HVAC was not integrated, as it is not compatible with third party control, and the client didn’t want it. The clients use the accompanying application to control HVAC manually.

We were disappointed to not install any motorized window treatments. Nothing moves in this house except the PTZs.

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