Wired for the Future: Smart Homes and Buildings Take Shape

There was a time past when Hollywood movies and television shows with futuristic themes depicted fully automated work environments and homes that functioned at the flick of a switch, push of a button, or were activated by digital voice commands. While this robotic technology may have seemed a bit far-fetched at the time, audiences then were actually being treated to a glimpse of the future in which we would work and play. That future is now, and the technology is here.

Leading technology, publishing, and home development companies are poised to offer an easy and affordable standard for wiring homes to efficiently handle everything from temperature controls and lighting to security and Internet access. From the pages of an architect's blueprints, these so-called smart buildings and homes are taking their place on the American landscape.

Converging Technology Revolution

The convergence of voice, data, and video (VDV) has triggered a technological chain of events that will likely affect our work and home environments in ways we never imagined.

Newly constructed office buildings are being outfitted with telecommunications infrastructures that enable them to continuously respond and adapt to changing conditions. They allow more efficient use of resources and provide a secure environment for workers at all hours. These smart buildings utilize automated control systems that link communications (voice and data) with building management (HVAC, fire and life safety, lighting, security, and access control). In the event of a fire, for example, the fire alarm communicates with the security system that there is a fire emergency in the building. The security system tells the HVAC system to regulate the flow of air to prevent the fire from spreading. These smart buildings are constructed around a computerized central control system that coordinates all of these functions at the touch of a button on either a fixed console or a remote control device.

Smart homes and office buildings are being designed with energy efficiency in mind. A central computer located in the home or office building can even be programmed to act automatically so that the lighting level gradually increases inside when the sun sets outside. The computer also turns off the lights once people leave the room; thus saving energy and making light switches obsolete. The temperature of a home or office building can be determined by strategically placed sensors that detect when temperatures vary from pre-set values and adjust the temperature accordingly for individual rooms.

IBEW and the Low-Voltage Revolution

In existing buildings, electrical workers are learning the technology that will

bring these structures up to speed with 21st century innovations. The construction industry's role in this technology will mean building offices where low-voltage and fiber optic cables will operate in a coordinated fashion, balancing signals carrying VDV, security and surveillance, fire and life safety information, building access data and HVAC sensor and control readings.

The increased use of VDV systems is creating more opportunities within the electrical industry. Contractors currently include low-voltage control system installation (voice, data and video systems) along with heating, ventilation, and air conditioning (HVAC), fire and life safety, lighting, and security and access control. While the electrical industry sees the need for integrated systems, successful implementation of convergent building technologies will rely on what the industry decides on as a single-source approach to integrate the various systems. The Telecommunications Industry Association (TIA) and the Electronics Industries Association (EIA) recently approved the Category 5e (enhanced) cable-testing standard (officially known as the TIA/EIA 568-A.5 standard). Standardized cabling used in smart buildings and homes will save on maintenance and upgrading. Smart buildings and homes that are constructed with single solutions in mind will require electrical workers to additionally service the components they install in smart buildings and homes.

Jim Boyd, senior director of curriculum development and training with the National Joint Apprenticeship and Training Committee (NJATC) says that the industry is gradually moving from a copper to a fiber optic cable environment. "Fiber optic has a greater bandwidth, is able to accommodate more data, and is far less subject to electromagnetic interference." But copper has been used for so long that there may be some hesitancy to abandon it all together. At present the biggest challenge fiber optics faces is economic. Cable television and telephone companies run twisted wire pairs or coaxial cables from optical network units to individual homes because it is cheaper than using all fiber optic cabling. For now, fiber will continue to operate with copper cabling.

The International Brotherhood of Electrical Workers (IBEW) and the National Electrical Contractors Association (NECA) are committed to providing the skilled manpower who will do the work on these structures that eventually become smart buildings. Skills and knowledge requirements for voice, data and video installation will only increase for members who enter the apprentice program offered by NJATC. According to Boyd, the number of apprentices entering the installer/technician program will increase as the VDV technology continues to expand.

"We have seen an increase in the number of apprentices entering the (installer/technician) program," he says. "In Minneapolis, for example, there has been a large increase of VDV apprentices."

The NJATC curriculum consists of the inside wireman, lineman, telecommunication installer/technician and residential wireman programs. As VDV technology increases, apprentices in each program need to continually develop and refine those skills needed to succeed in the telecommunications industry. The NJATC requires electrical apprentices to successfully complete a structured national curriculum that combines classroom work and on-the-job training. Apprentices in the installer/technician program receive 480 hours of classroom work and 4,800 hours of on-the-job training.

Technology Fuels Construction Future

In the 1980s, a series of articles in trade journals and magazines featured buildings equipped with automated systems to make the structure more energy efficient. Much of the technology that is fueling the smart building movement today was either not readily available then or was not accepted in some circles. But the persistent desire to expand Internet technology has given way to a brave new world where homes and buildings no longer function as passive structures designed to shelter. Copper or fiber optic cabling installed in these structures transports a VDV technology in a way that redefines the traditional functions of a home or office building. The burgeoning VDV market also means a growth in the number of electrical contractors who will be needed to service the smart buildings. Skyscrapers, mid-sized buildings, small buildings, hotels, residential areas and shopping malls that are equipped with VDV technology expand the opportunities for electrical contractors who will service them.

Smart building systems will provide much more than today's simple electronic control. They will optimize operations across building systems, inform and implement energy purchasing, guide maintenance activities, and report building performance, while ensuring that workers' comfort, health, and safety needs are met at lowest possible cost. In order to achieve these benefits, essential information (design, intent and construction implementation data) will be preserved and shared across many applications throughout the building's lifetime. Building equipment and system performance records will contain information designed to provide designers, equipment manufacturers, building operators and owners feedback on the condition of the building's systems.