

Smart House And Home Automation Technologies

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SMART HOUSE AND HOME AUTOMATION TECHNOLOGIES

A “smart house” that responds to the dweller’s needs and desires by adjusting lighting, temperature, even ambient music, has appeared in science fiction for much of the twentieth century. From LeCorbusier’s vision of the house as a machine for living, to Negroponte’s Architecture Machine, home automation technologies are the latest extension of a century-long fascination with housing and mechanism. However, with the development of new electronic technologies and their integration with older, traditional building technologies, the intelligent home is at last becoming a real possibility.

The basic idea of home automation is to employ sensors and control systems to monitor a dwelling, and accordingly adjust the various mechanisms that provide heat, ventilation, lighting, and other services. By more closely tuning the dwelling’s mechanical systems to the dweller’s needs, the automated “intelligent” home can provide a safer, more comfortable, and more economical dwelling. For example, the electronic controller of an automated home can determine when the dwellers have gone to bed and turn off the lights and lower the thermostat; it can monitor burglar and fire alarms; it can anticipate hot water usage and optimize the operation of the water heater.

The Smart House Project was initiated in the early 1980’s as a project of the National Research Center of the National Association of Home Builders (NAHB) with the cooperation of a collection of major industrial partners. The “smart house” technology is one realization of home automation ideals using a specific set of technologies. In Smart House technology, the dwelling is wired with a single multiconductor cable that includes electric power wires, communications cables for telephone

and video, and other conductors that connect appliances and lamps with electronic devices that control the supply and switching of power.

A principal benefit claimed for the Smart House technology is safety. With current technology, electric power is provided to all appliances that are plugged into a wall outlet. Cutting a wire, inserting a screwdriver into a wall outlet, or a fault inside the appliance can result in a severe electric shock. The Smart House, in contrast, provides power only to outlets that have appliances plugged in and turned on, and the smart house controllers monitor the circuit, disconnecting power at the first indication of a short circuit or other failure. In addition, when sensors detect gas and water leaks, smoke, and other abnormal conditions the electronic controllers can shut down the appropriate devices and trigger the alarm.

A second benefit is convenience. Traditional wiring in North America provides only 110 volt power outlets, with occasional 220 volt service for heavy appliances. However, most of today's consumer electronic appliances such as radios, personal computers, and even power tools step the line voltage from 110 down to 6, 9, 12, or 24 volts. Smart House technology includes provision for power at several voltage levels, eliminating the need for numerous small power adapters at each appliance. The Smart House cabling provides a single outlet for power and communications; gas is provided through flexible tubing and its own, quick-connect outlets. In addition, Smart House technology can automatically control the temperature, humidity, and lighting in the dwelling on a room by room basis.

A third benefit is economy. The Smart House technology would adjust the power supplied to each appliance according to need. In the traditional scheme, each appliance is provided with sufficient

power to provide for its peak use. In addition, the Smart House controllers could schedule the operation of heavy power consuming appliances (such as dishwashers, electric water heaters, and air conditioners) to take maximum advantage of off-peak electric rates. These adjustments could result in lower utility costs.

A great deal of groundwork has been done to coordinate the building industry infrastructure in preparation for bringing Smart House technology to market. Whether Smart House and other home automation technologies succeed at changing standard residential construction, it is clear that at least some of the innovations are already entering the marketplace, albeit in fragmentary forms. For example, ground fault interrupted circuits, which detect an electric shock incident (a “ground fault”) and shut down immediately, are now commonly used in bathrooms, kitchens, and in outside outlets. Likewise, telephone, television, and other communication services are undergoing tremendous changes and this will no doubt affect the way these services are delivered inside the dwelling. In some instances, third-party vendors sell the sensors and controller units to connect the security system, lights, telephone, and other devices to a personal computer. For example, these devices allow the homeowner to call home and instruct the computer to “turn on the oven at 4 PM and heat up the hot tub.”

Smart House and other home automation technologies require widespread changes to the way buildings are made, changes that call for cooperation among the manufacturers of construction components, utility suppliers, and regulatory agencies that oversee the building industry. With the rapid changes in electronic and materials technology, it may well be that new standard building technologies will become obsolete by the time it can gain a footing. Providers for cable television, telephone, and new communications services are struggling to define technological standards, and

the ownership of copper wire and fiber optic cable networks to each dwelling has been a valuable resource held by local telephone and electric companies. These organizational changes in the urban infrastructure may well have an impact on the way housing is wired and cabled for power and communications. The new information infrastructure being developed offers the possibility of broader participation in civic and community activities, access to educational resources, as well as work, shopping and entertainment. Already the fax, the modem enable people to work at home and browse information databases over conventional telephone lines. Higher bandwidth communication technologies are being developed to provide electronic community town meetings, distance learning, home shopping, and video on demand. However, it remains to be seen whether the technology will enhance and enrich the lives of citizens.

Finally, even after technical and organizational challenges are met, many will find a fine line between an intelligent house that maintains comfort levels and an overbearing house that monitors the inhabitants too closely. Few people object to using a thermostat to control the temperature in a house, but most cherish the power to set and reset the thermostat. As the hardware and software to control home automation systems become increasingly complex, human interface designers must make it easy for dwellers to program the house and to override preprogrammed settings.

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