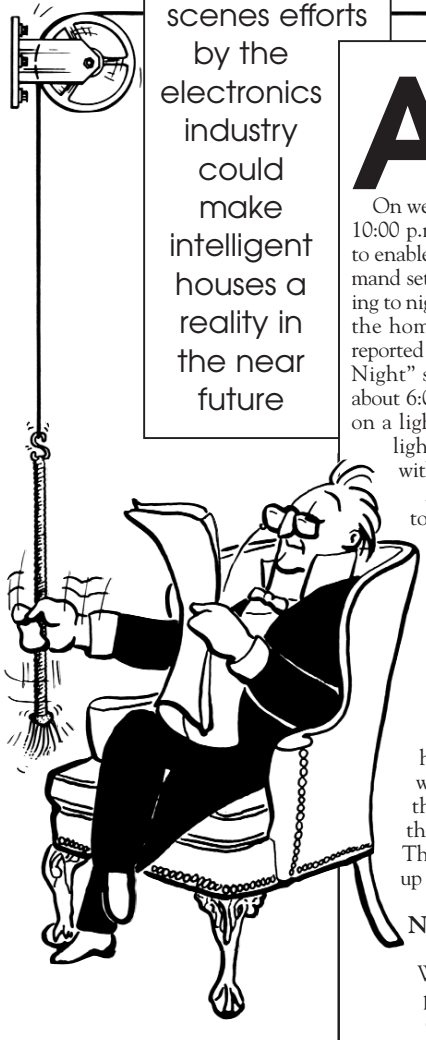
Home Automation Outlook

by Tricia Parks

Behind-the-scenes efforts by the electronics industry could make intelligent houses a reality in the near future



A couple in New England call their house before returning from vacation, and tell it to warm up. When they arrive home an hour later, the inside temperature is comfortable.

On weeknights, Joe and Anne both go to bed about 10:00 p.m. Before going to bed, they use their phone to enable a "Good Night" house script. This one command sets back their thermostat, sets the house lighting to nighttime, arms the security systems, and checks the home's electronic locks. All of this activity is reported back to Anne and Joe. Better yet, the "Good Night" script triggers a "Good Morning" script at about 6:00 a.m., which turns up the thermostat, turns on a light in the master bath, turns off the outside lighting at dawn, and wakes up Anne and Joe with their favorite radio station.

A woman gets up in the middle of the night to get a cold drink of water from the refrigerator. The house gently brings up the lights in front of her as she walks and then turns them off as she passes. The security system keeps track of her so it knows not to call the police as she passes the sensors. If it had detected a new presence (potentially a burglar), it would sound the alarm and tell her what room had been broken into.

A washing machine in a Southwestern home, loaded with clothes the night before, waits to start until late the next morning. At that time, the solar water heater tells it that there is enough warm water to wash clothes. This prevents the washing machine from using up all the hot water while the sun is down.

Network Standards Lacking

Any of these scenarios is possible today. With "smart" products — VCRs, microwaves, programmable thermostats, sprinkler controls, etc. — already common in U.S. homes, all that is lacking is the ability for products to "talk" and "listen" to one another — to *network*.

A network can be as small as two appliances that can talk to each other or as comprehensive as all the electronic products in a home talking to each other. At the comprehensive end, some homes will include a central controller with the sole task of managing communications and actions between all systems based on the homeowner's instructions.

At present, what is necessary for home automation technology to be more affordable are industry-wide network standards. A network standard means that participating manufacturers would all use the same electronic language for communication between products. Every product in a network would contain the same microprocessor chip. That means you could send an "on" or an "off" command to any product using one controller — all the products in the network, regardless of who manufactured them, would be speaking the same electronic language.

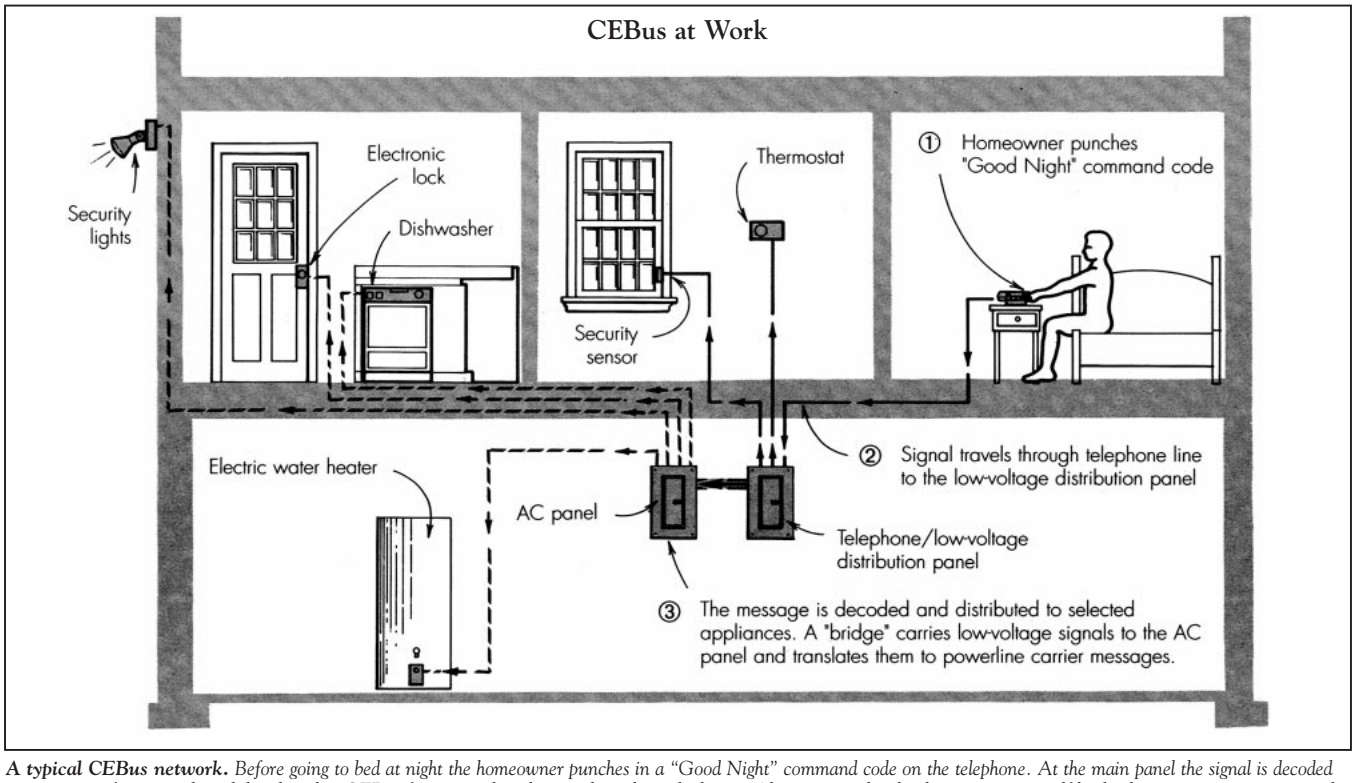
Since all participating manufacturers will use the same chip, semiconductor companies will be able to manufacture in high volumes, thus decreasing chip costs. This, in turn, will allow manufacturers to add these capabilities to their products at prices that people can afford.

Efforts to Develop A Network Standard

Over the past several years, manufacturers who wish to make more comprehensive systems than are possible with X-10, but also wish to be able to work with other manufacturers' products, have been working toward the development of standardized automation networks for the home.

In the U.S., there are three different home network efforts: Consumer Electronic Bus (CEBus), Smart House, and Echelon. These efforts are different in scope, business structure, and intended markets.

Consumer electronics manufacturers are supporting CEBus. Some large companies, such as Carrier and



A typical CEBus network. *Before going to bed at night the homeowner punches in a "Good Night" command code on the telephone. At the main panel the signal is decoded into a series of commands and distributed to CEBus fixtures and appliances throughout the house. Almost instantly, the thermostat sets itself back, the security system is armed, the dishwasher starts, the exterior doors lock, the water heater turns off, and outside security lights turn on. Finally, a system timer automatically reverses these functions at a set time the following morning.*

Eaton, are supporting Smart House for new construction and another effort for retrofit. Several companies have announced the intention to work with Echelon.

Which of these standards will predominate? It is unlikely that there will be one big winner for some time to come. Remember the VHS-vs.-Beta battle. Most likely, two or maybe all three of these efforts will come to the market and fight the battle there. From that point, the market will determine ultimate winners.

CEBus

The only North American effort that meets the definition of an open standard is the Electronic Industries Association's CEBus. Under the auspices of ANSI, this is a committee effort with volunteer participation and is open to all companies, large or small. There are no fees to participate and there will be no fees (or minimal fees) for manufacturers to use the CEBus standard after its completion.

The CEBus system allows manufacturers from different industries and from different companies within the same industry to send messages to one another's systems using common *protocol* (electronic "rules of the road") and using a common electronic code on the chips.

Manufacturers can send their messages on any media found in the home. These include:

- powerline carrier (electric wire)
- twisted pair (telephone wire)
- radio frequency (air)
- infrared (line of sight)
- coaxial cable
- optical fiber (eventually)

Manufacturers can use as many media as is necessary to send their messages from one place to another. *Bridges* allow a message to cross from one media to another; for example, from a hand-held remote controller to a telephone line. These bridges are built into the standard and only require a homeowner to purchase *media interface nodes*.

One CEBus goal is to allow homeowners to build networks as simple (two products that communicate) or as sophisticated as they want. The illustration above offers an example of a possible CEBus network.

CEBus will be simple, and even invisible, to the consumer. But that doesn't mean it has been simple to develop. Begun in 1984, it is the most comprehensive nonmilitary standards effort in U.S. history. The complete standard — except for the optical fiber portion — has already been released. But at this point it is still only paper — 30 pounds of it! Manufacturers must now take steps to create silicon chips, develop systems to design new products, and, ultimately, bring new products to market. Many are betting that a large number of companies will adopt CEBus due to its comprehensiveness, openness, and relatively low cost.

The cost of adding full CEBus wiring (extra telephone wire and coaxial cable) is estimated at $800 more than traditional wiring for a new 2,500-square-foot home. Existing homes can use media that require no additional wire (powerline, radio frequency, infrared) or can add coaxial cable or twisted pair where necessary.

Early CEBus products are likely to have premium prices during market development. As volume develops, prices will decrease.

Smart House

The Smart House Limited Partnership (SHLP) is a for-profit consortium funded by the National Association of Home Builders and wealthy home builder investors. Its goal, enabled after Congress passed The National Act of Cooperation in 1984, is to help American competitiveness in the housing industry by encouraging research and development, to advance the state of American housing. Moreover, SHLP seeks to help its constituents — home builders — by providing U.S. consumers seeking a house with compelling reasons to purchase a new, rather than an existing, home.

Smart House completely redefines the wiring of the home. The system uses three types of multiconductor cable as well as gas plumbing. All the applicable hybrid cables are new designs created by SHLP. As these must be installed at the time of construction, for the time being Smart House is only appropriate for new housing. The house-wide network requires control by a central controller. Consortium members such as Carrier and AMP are creating Attached Products that will use the Smart House network.

Unlike CEBus, Smart House is a closed proprietary system. That is, a company must join the Smart House consortium for a fee in order to be allowed to make a product. Consequently, few entrepreneurial efforts can afford to participate. It is a complex and ambitious system. Because of new wiring as well as the development of new product types, Smart House is also initially expensive.

Smart House is being released in two stages: Smart-Redi and Full Smart. Smart-Redi, which is currently available, includes all the wiring necessary to install a Smart House system. The price of Smart-Redi for a 2,500-square-foot home is $9,000. The central controller required to operate Smart House will not be ready until mid-1992, and will cost between $3,000 and $6,000. Prices for Attached Products have not yet been announced, but will undoubtedly carry early premiums due to low volume.

SHLP is well-equipped to train installers in the requirements of Smart House and is currently setting up service centers for maintenance. One such service licensee is Sears Commercial Installers.

Echelon

Echelon, founded in 1987, offers yet another philosophy toward creat-

Affordable Automation

Not every homeowner needs, or wants, a full-blown whole-house automation system. Focus on the specific wishes of your customers, though, and you'll probably find that you can meet their automation needs at a reasonable cost. If hvac control is the aim, a setback thermostat is the best option. For localized lighting control, an in-line programmable timer or a floodlight equipped with a motion detector may be enough. For a more elaborate lighting scheme, you may want to consider *powerline carrier* (PLC) controls.

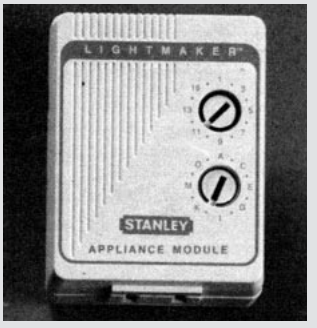


Figure A. *X-10-type receiver modules, such as this one from Stanley Home Automation, can be set to one of 256 possible "addresses" by turning the small dials. The homeowner can then control the appliance plugged into the receiver from a remote controller.*

Powerline Carrier Technology

Powerline carrier technology, sometimes called *X-10* after its original manufacturer, X-10 (USA) Inc. (185A LeGrand Ave., Northvale, N.J. 07647; 800/526-0027), uses existing AC wiring to carry electronic messages. X-10 is simple to use. In the do-it-yourself versions, you plug in a receiver module at one receptacle and a control module at another (see Figure A). The receiver module is set for a certain "address" — 256 to choose from — and a lamp plugged in. From the control module, in another part of the house, you send an "on" or "off" (or "dim" or "brighten") signal to the correct address, and the light responds. You can set several lamps or appliances for the same address and they will respond together.

Leviton. Powerline carrier technology has, for the most part, been pitched to the do-it-yourself market and not to the trades. However, one manufacturer, Leviton (59-25 Little Neck Pkwy., Little Neck, NY 11362; 800/323-8920), has incorporated PLC technology in its professional-quality "Decora Electronic Controls" line of lighting and appliance controls. Leviton's PLC modules install like conventional switches and receptacles, right in the box, for a finished appearance not possible with the plug-in X-10 modules.

Leviton has also addressed the biggest problem with X-10 technology — interference in the powerlines — by developing in-line noise filters and signal boosters. Test equipment is also available to enable the installer to locate and deal with sources of interference.

Leviton's PLC controls are equally useful for new construction or remodeling. If you ever have to fish wires for a three-way light circuit you may want to consider using Leviton's electronic controls. Using a hard-wired controller in one box and a switch module in another, it's possible to create three-way light switching without installing a three-way wiring circuit. The boxes don't even have to be on the same circuit.

PLC Controllers

X-10 technology can do more than control isolated lights or appliances. Several manufacturers have developed X-10 network controllers with varying levels of sophistication.

Enerlogic. For $395, the Enerlogic System 1400, made by Enerlogic Systems Inc. (2 Townsend W., Suite 6, Nashua, N.H. 03063; 603/880-4066) is a PC-based, programmable controller that monitors all the X-10 signals in a house. (This should not be confused with the $70 programmable controller made by X-10 Inc., which is essentially a timer device.) The System 1400 can "hear" any signal on line and use it as an input message to initiate other commands. For example, a signal issued from an X-10 timer can be used to send a series of different commands to X-10 modules around the house. After being programmed on a PC, the box simply plugs into any outlet in the house.

Figure B. *The Samantha system combines X-10 control with a touch-tone phone, intercom, and answering machine.*

Samantha. Group Three Technologies Inc. (2125-B Madera Rd., Simi Valley, CA 93605; 805/582-4410) has combined X-10 technology with a touch-tone telephone to create a sleek PLC controller (see Figure B). The Samantha system uses existing house telephone wiring to give two-line telephone, intercom, and answering machine capability as well as a bridge to the AC lines for the X-10 communication. Control is by keypad or touch-tone telephone. A voice help menu is included for ease of use. The system starts at around $1,500.

Butler-in-a-Box. The Butler-in-a-Box PLC controller (Mastervoice Inc., 10523 Humboldt St., Los Alamitos, CA 90720; 213/594-6581) uses advanced voice-recognition technology (see Figure C). The user speaks the command and the Butler executes it and gives an appropriate voice response. The device, which can distinguish between four different users, is about the size of an answering machine. It's also a voice-controlled telephone, allowing the user to dial a number and converse while seated away from the unit. The Butler-in-a-Box is particularly well-suited for handicapped persons or others of limited mobility. The basic unit starts at around $3,000.

Figure C. *With its voice-activated controller, the Butler-in-a-Box is ideal for handicapped persons. It controls lights and appliances through X-10 technology.*

Midrange Systems

X-10 technology is best suited for controlling lights and small appliances. If you want a reliable security system however, plus integrated hvac control, you have to move up to a system that uses more than just a PLC format. Reliable security and multi-zone hvac control require dedicated low-voltage wiring circuits for motion detectors, temperature sensors, and the like. All the available integrated systems provide this, but most of them cost more than $10,000 installed.

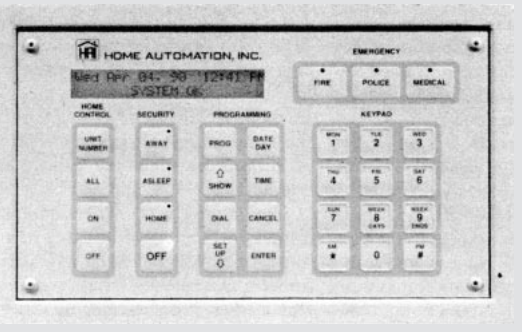


Figure D. *Home Automation Inc. offers electronic home control at a moderate price. Using this keypad or a touch-tone telephone, the homeowner can control hvac, lighting, appliances, and a security system.*

Home Automation, Inc. One integrated system offers reliability — if no flash — for a reasonable price. For around $3,500, Home Automation Inc. (2313 Metairie Rd., Metairie, LA 70001; 504/833-7256) can equip a 2,500-square-foot house with a 22-zone security system, plus hvac, lighting, and appliance control, all operated from a single keypad (see Figure D). The homeowner can also access the system by touch-tone telephone, to get status reports and to arm or disarm the system.

Several home automation professionals I spoke with consider the Home Automation Inc. system to be the best buy currently available in an integrated system. They cited its practicality — it is based around a full-featured security system rather than any "gee whiz" technology — as well as its affordability.

Affordable entertainment. Another system mentioned enthusiastically is the Elan Home Entertainment Network (Square D, 987 Primrose Ct. Lexington, KY 40511; 800/622-3526). Elan is not an automation system per se; it provides an economical way to distribute audio, video, and telephone throughout the house. A Square D

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panel houses the distribution center. From there, dual coax cable (one cable for the outside cable signal and one for internal signals such as VCR or monitor cameras), speaker wire, and telephone wire are distributed throughout the house. The system provides mono or stereo speakers with volume controls, a telephone paging system, up to three incoming telephone lines, plus the video distribution. Extras include a home theater package and a closed circuit TV system. The basic Elan system retails for around $1,000 (uninstalled).

Some automation specialists see Elan as more than just a reasonably priced entertainment system. The wiring configuration, they believe, provides a built-in wiring infrastructure for future CEBus applications. This means that a home wired with Elan will probably be able to use a full range of CEBus appliances when they come to market.

High-End Systems

If your client has the resources there are some upper-end systems you may want to consider. These systems all provide full security, hvac and lighting control, a telephone interface, and central and remote control. Each has its own unique features and design, so contact the manufacturer for specifics.

Magic Mansions (Magic Mansions Inc., 2501 E. Oakton, Elk Grove Village IL 60007; 708/364-5257) uses a proprietary wiring scheme. The telephone is the main controller. Basic systems start at $6,000.

If your customer likes touch screens, consider the Home Manager system (Unity Systems Inc., 2606 Spring St., Redwood City, CA 94063; 800/558-6489, 800/858-6489 in Calif.). This product has been on the market since 1984; there are 2,500 installations. Prices range from $8,000 to $25,000 installed, depending on size and complexity.

Domain 6000 (Intelligent Systems Inc., 175 New Britain Ave., Plainview, CT 06062) uses fiber optic cable, which carries a very clean signal. Installations start at around $10,000.

Maestro (CompuHome Systems Inc., 2645 Snyder Ct., Walnut Creek, CA 94598; 415/932-1346) uses a hand-held radio-frequency controller. A dedicated channel on the TV gives the operator visual feedback. A beginning system costs $10,000 to $12,000 installed.

– Don Jackson

ing a network. Unlike CEBus or Smart House, Echelon's network design is intended for *any* environment in which electronic products need to communicate. Their premise is that the requirements for electronic communications are nearly identical within environments even when the environments themselves are very different. So while airplanes, cars, factories, businesses, and homes may be different, the communication needs of their component systems and products are nearly the same.

Echelon has created LONWorks (Local Operating Network) which includes all the pieces necessary to build a network. Like CEBus, LON is a multi-media network, but it is not an end-user product. That is, manufacturers will use it to achieve communications in their own products, but consumers won't go out and purchase an Echelon product. Instead they will purchase "Brand X" telephone that includes Echelon's technology. Unlike CEBus, Echelon is a for-profit venture, and is aggressively pursuing the adoption of its network techniques by providing manufacturers with development tools that will help them create LON-based products. CEBus, an industry specification, must wait for companies that see market opportunity to build its development tools.

To make money for its investors, Echelon is licensing its technology to chipmakers and offering development systems to companies wishing to design products. Toshiba and Motorola have both signed licenses to create the LON Neuron chip, the heart of the system. Echelon will receive a royalty for chips.

In September 1991, Echelon announced the formation of a consortium of companies joining to create home automation products using the Echelon technology. These include Square D, Unity Systems, Diablo Research, Honeywell, and Leviton, among others. Some of these consortium members are also involved with CEBus, Smart House, or both.

Echelon is well managed and has excellent engineering talent. It has hardware to show the world and tools to help manufacturers streamline product design time. Its challenges include convincing enough manufacturers to use its technology to create a critical mass of products for consumers to choose from, as well as maintaining pricing levels for products that are palatable to consumers.

What's Available Today?

Today, nearly all home automation is occurring through one of two means. The first is X-10 technology, (see "Affordable Automation"). It sends one-way encoded messages on the home's AC powerline from a small controller on the powerline to plug-in modules that deliver the message to the appropriate appliance.

X-10 products sell under the X-10 name as well as under label arrangements with companies such as Radio Shack, Schlage Lock, Leviton, Black & Decker, and Stanley. Its best known products are basic controllers and modules that are inexpensive and simple to install. The consumer places the controller in one place and plug-in modules wherever he wishes to control a product, whether it is a light, a stereo, or a television. When the consumer hits a control key, the X-10 controller sends an "on" or "off" message to the appropriate module. The message travels over the home's 120-volt powerline in a protected manner to avoid noise interference.

Limitations. Just under two million homes in the United States have some kind of simple X-10-style controller. But while X-10 has an excellent market, it contains some inherent limitations for manufacturers with sophisticated or critical control functions. First, it sends only a one-way message, so the only feedback that a consumer has is from the environment: i.e., if the light goes on, the control worked; if it didn't go on, the control didn't work. That may be okay for lighting, but homeowners want feedback for functions such as arming the security system or locking the front door from the bedroom.

In addition, X-10's technology uses the powerline as its predominant media. The powerline is a messy environment, with potential for noise and interference. To ensure reliability is difficult, and X-10's technology, created in the late 1970s, is not the latest available. However, X-10 is making an effort to update and has already expanded into radio frequency technology.

Upscale automation. Besides X-10, there are also several proprietary efforts by small or very upscale companies who sell integrated whole-house automation packages. These use their own network schemes to send messages from one system to another.

Many of the proprietary systems do their tasks extremely well; some are very sophisticated. Unfortunately, as each uses its own network method, it is impossible to simply buy and add another product to the home. Each purchase must be compatible with the system's message-sending network. This can be difficult and expensive. As a result, these proprietary systems are limited today to the most adventurous or wealthiest of families.

What Does This Mean for You?

The '90s are the beginning of a rich evolving market for home systems. While some of these will be plug-and-play, many will require professional installation and set up. Examples of burgeoning system markets include: hvac zoning, home theater, telecommunications, advanced security, and, ultimately, systems integration across these categories.

More installers needed. Considering that there are 93 million homes in the U.S., many more installers than are currently available are necessary to serve this market. In fact, without capable installers, manufacturers fear introducing sophisticated products. Nothing turns consumers off more quickly than faulty installation or flawed service.

The first markets for these systems are upscale homeowners with the desire and money to invest in systems of higher performance and greater convenience. The installation and service capabilities required are more like those currently needed in light commercial construction than those often used in residential areas.

For installers with a desire and the capability to grow, the market is open. Positions of local and regional dominance are available. But before any installer can correctly assess both the risks and opportunities of home systems, a solid understanding of the consumers involved, the manufacturers, and systems integration is essential.

This will be a slow, but steady market, reminiscent of central air-conditioning. Solid growth will occur for at least the next 20 years. For those with the desire, it represents an excellent business adjunct or new opportunity. ■

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Resources

For more information on home automation, or names of dealers and installers in your area, contact the Home Automation Association, 1223 Potomac St. N.W., Washington, DC 20007; 202/333-8579.

For a technical review of home automation you may want to read David Gaddis's *How To Automate Your Home*. The 128-page paperbound book is available for $29.95 from Home Systems Inc., P.O. Box 6236, Edmond OK 73083; 405/840-4751.

Home Automation Systems: State of the Art is a well-written and informative pamphlet published by the National Electrical Contractors Association in their Electrical Design Library series. The 15-page booklet is available for $5 from NECA, 7315 Wisconsin Ave., Bethesda, MD 20814; 301/657-3110.