Home Automation

Home automation is the automated or remote control of appliances and equipment in the home. Automated controls can be used to turn equipment on or off or adjust the operating settings at pre-determined times, on-site or remotely, or can be set to adjust the operation of equipment in response to changes in the home environment, eg. temperature. Homes using these techniques, which may also involve the integration of broadband communications, are sometimes called Smart Homes or Smart Houses.
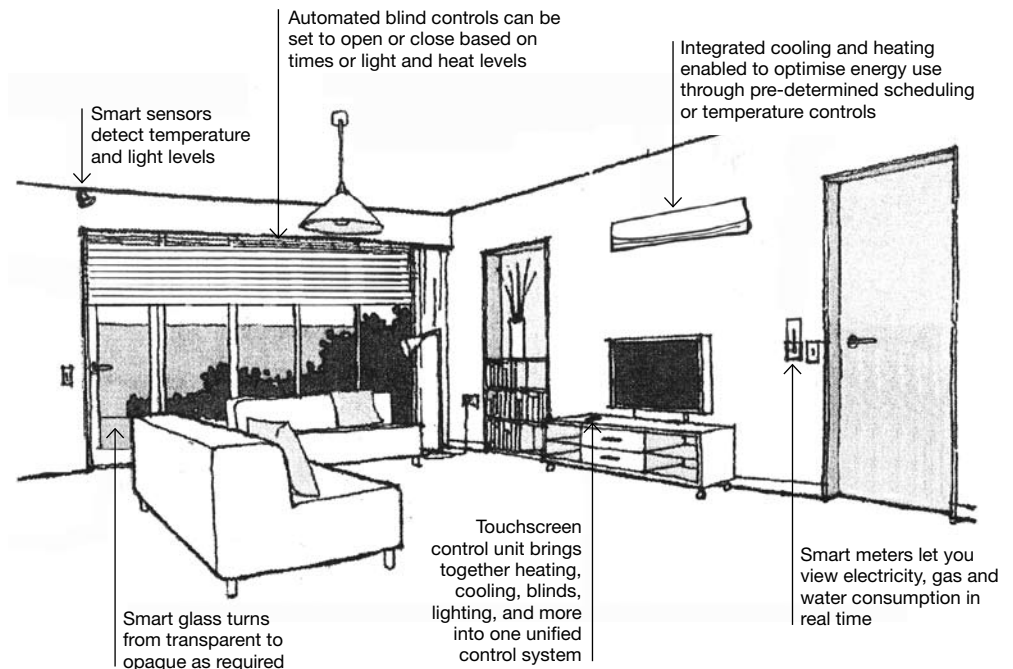
Home automation can either be centralised and programmable, or consist of decentralised and isolated sensors and controls. It can involve sophisticated electronic programmable controls for lighting, heating, cooling and entertainment devices using a special wiring or wireless controls, or just a few isolated systems being automated, such as motion sensors to control lights.

Home automation systems can only improve the energy efficiency of your home if they are designed for this purpose.

Operating automated systems uses energy, so the automated systems will only lead to energy savings if they save more energy than they use.

Priority should first be given to designing an energy efficient home and installing high energy efficient appliances and lighting. Home automation can save energy if it reduces the time that equipment operates or reduces the need to use equipment, eg. by only switching on lights when they are needed.

Aim to design home automation systems to reduce the need for operating or the time that energy-using equipment operates.

Automated blind controls can be set to open or close based on times or light and heat levels

Smart sensors detect temperature and light levels

Integrated cooling and heating enabled to optimise energy use through pre-determined scheduling or temperature controls

Smart glass turns from transparent to opaque as required

Touchscreen control unit brings together heating, cooling, blinds, lighting, and more into one unified control system

Smart meters let you view electricity, gas and water consumption in real time

Heating and cooling

A well designed automation system can:

1. Improve passive solar heating and passive cooling through the control of blinds, awnings, windows, vents and fans.

2. Control heaters and air conditioners so they are only used when and where they are needed and are use to achieve a desired temperature.

Design your home to make the best use of solar energy and natural ventilation for passive heating and cooling before you consider your automation options. [See: 4.5 Passive Solar Heating; 4.6 Passive Cooling]

Use temperature sensors in different rooms to control heating and cooling. Appropriate placement of temperature sensors and the use of heating/AC timers can significantly reduce energy use, even if automated systems are not used.

Analyse your heating/cooling needs and how you will manage these. Ask yourself what rooms need to be heated/cooled, when and to what temperature? Aim to heat/cool living areas when people are home but heat/cool bedrooms only at night and the early morning when they occupied. Bedrooms do not need to be made as warm or as cool as living areas, to be comfortable for sleeping. Avoid heating and cooling halls, laundries etc. [See: 4.2 Design for Climate]

Plan your automation system. Consider how opening and closing blinds, awnings, windows and vents can assist passive heating, cooling and natural lighting. Explore how switching on and off of fans and heat shifters might reduce the need for cooling or heating. Consider how better temperature and the timing of use can minimise the energy used in heaters and air conditioners/coolers. Use these answers to decide on your automation needs.

Hot water

Automate the hot water system so it can be switched off when not required, such as when household is absent on holidays. Solar systems can be controlled so they do not require heat boosting during summer months.

Lights

Automate lights so they operated only when needed and switch themselves off when rooms are vacant. This can be done through motion sensors and timers or through more elaborate centralised systems.

Use motion sensors to switch on external lights when needed, or lights when entering the home, rather than leaving lights on.

Use motion sensors, light sensors and timing controls to switch off lights when they are no longer needed, (eg. Room lights may be switched off after 5 minutes if no motion is detected). Give priority to rooms that often have lights left on unnecessarily, like bathrooms, pantries and toilets. However, consider these options carefully as five minutes of inaction in front of a TV is not unusual and you may not want the lights to all go off then!

Appliances and equipment

Use controls to operate appliances and equipment only when they are needed.

Remote control and timer control of appliances, from coffee makers to home theatres to spas, can lead to energy savings if the appliances can be switched off when not required.

Care should be taken not to turn on appliances automatically or at pre-set times as this may lead to additional energy consumption when there is no need for the appliance to operate.

Automating equipment control to reduce operating times is particularly useful if the appliances normally use standby power, even though they are not operating, eg. Stereos, TVs, DVDs and home office equipment. It is also useful when the need for the equipment to operate varies, such as for pool pumps, where daily operating hours can be matched to the season.

Automation equipment, sensors and controls

Home automation systems work by managing the electric power of the equipment being automatically controlled. The degree of 'intelligence' and how it is distributed between the elements of the home automation system varies with the design and with the manufacturer.

Control can be implemented by isolated sensors timers and processors embedded in the switches and relays. Alternatively centralised control can be obtained through networked sensors linked to a controller or computer which then operate the power systems of equipment throughout the house.

The operation of more sophisticated equipment such as central heaters, air conditioners or home theatres, can also be bought under the control of the automation system, but with more intelligent controlled devices, care is needed to ensure that the controller's instructions do not create conflicts.

Automation equipment potentially can include any appliance or machinery in the home, the operation of which is controlled through its electricity supply. This list might include:

> Hot water systems.

> Appliances.

> Home office, home entertainment and other electronic equipment.

> Lighting.

> Heating and cooling/air conditioning systems.

> Fans and air pumps/heat shifters.

> Powered window blinds, shutters and awnings.

> Powered vents and window openings.

> Water pumps, pool pumps and spas.

> Garage doors.

> Security systems.

Sensors that can be integrated into the automation system can include:

> Motion sensors.

> Light sensors.

> Temperature sensors.

Control of the home and its lighting, appliances etc can performed by:

> On-site controllers, which may be special proprietary devices, often activate by touchscreens, or standard computers.

> Remote controllers, allowing equipment to be controlled outside the home or at a distance in the home. Again, these may be proprietary devices, or standard mobile phones or computers.

> Sensors, which operate the home equipment in response to changes in the home environment, such as the presence of occupants or changes in the external temperature.

Automation and electricity demand

In the near future, home automation systems may be linked to the electricity utility in a number of ways. The utility may communicate variations in electricity prices to a 'smart' electricity meter, that will interface with the home automation controller.

Householders can then program appliances to reduce power or switch off altogether during high price periods.

Alternatively householders could enter a supply contract that allows the electricity supplier to signal equipment controlled by the home automation system (such as air conditioners) to turn off certain equipment for short periods.

The householder may choose to participate and obtain lower electricity prices or other financial incentives.

ADDITIONAL READING

Smart Wired House
www.smartwiredhouse.com.au

Custom Electronic Design and Installation Association
www.cedia.com.au

Principal author:
Paul Ryan
Murray Pavia