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Technology for a sustainable future

Issue 144

SMART HOMES SPECIAL

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CASE STUDY 1: TALKING TO ALEXA

Amazon's voice-controlled intelligent personal assistant service Alexa is at the heart of the automation of Leanne and Scott's Melbourne home. As dedicated Apple phone and computer users, they'd expected that Apple Homekit would be "it". However, they've found there are currently more Alexa-compatible devices, so that has set their path.

The system consists of an Ecobee smart thermostat (pictured) and a number of Ecobee sensors, which can monitor temperature, humidity and room occupation in different rooms of the home. Alexa comes as part of the Ecobee thermostat, so no separate Amazon controller is needed.

Their hydronic heating is programmed to come on at specific times of day, but only if they are home: Alexa keeps track of this via the 'follow me' feature, which uses the Ecobee room sensors to determine who is where in the home. It can adjust the schedule settings if, for example, someone comes home early, and the Ecobee system can give different sensors priority for different times of the day. For example, overnight the heating is entirely dependent on the baby's room sensor, while in the evening, the thermostat focuses on the living room temperature.

They also have smart ceiling fans with integrated lights (Haiku from Big Ass Fans), which can be controlled from Alexa. The bedroom lights are programmed to come on at set times of the early morning/night, but only when they enter the room, with the lights switching off when they leave the room. This is something they've found particularly useful when they've got a baby in their arms. The smarts in the fans are interesting: the fans can talk to the Ecobee thermostats, so they know the temperature in the room and will adjust their speed and direction to optimise cooling or heating as required.

They've found Alexa's voice recognition quite good; around 90% of the time it understands them, even if there's a bit of background noise, say from the TV.

They also have a Rachio smart sprinkler controller that allows them to automate, update and run their sprinklers via their smartphones. They also use timers and delayed start functions to maximise appliances' use of solar energy, but are always looking for more sophisticated solar diversion devices.

While the integration of all the smart devices is still a bit "choppy" ("You can't access all the smart features from Alexa, so I often have to use the individual smart device app; this is a disadvantage compared to an expensive, hardwired upfront smart home setup using something like KNX," notes Scott), they've found they use Alexa every day and believe the smarts help them to more efficiently use their appliances—with more potential sustainability benefits to flow from greater integration with their heating system.

They also use IFTTT with Alexa where it's not fully integrated with other apps. For example, they can build to-do lists and reminders in Alexa and use IFTTT to transfer these to the Apple reminder app.

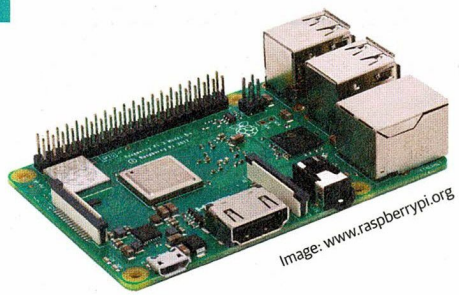

Image: www.raspberrypi.org

CASE STUDY 2: KNX AUTOMATION

Paul Hendy is a strong believer that automation has the potential to move passive solar homes into the mainstream, by making it easier to take advantage of cooling breezes or solar heat. He's demonstrating this as part of his own renovation where he has used KNX automation to enhance the sustainable operation of his family home in Adelaide (featured on the cover this issue).

KNX is a non-proprietary standard for home automation devices. You can buy KNX-compatible sensors (e.g. temperature, wind and CO_2 sensors) and actuators (e.g. window and blind openers, air conditioner controllers) and connect them to a 'data bus'. Each sensor gathers data and puts it onto the bus as what's called a 'telegram'. Actuators receive those data telegrams and act accordingly. Actuators are programmed by using a computer to upload applications to them to control how they respond to the telegrams—e.g. open a blind or a window.

The network of devices can be controlled by any computing device, from a simple microcontroller, such as a Raspberry Pi (which is what Paul uses, see photo), to a full-sized PC. You can use free KNX software, or add-ons that are more user-friendly, such as the Ilevia Eve software used by Paul, to program the logic of the system. Paul's system uses all common cat5e ethernet networking cable.

For Paul's house, the KNX system is driving summer ventilation and winter air transfer. He has combined temperature and humidity sensors with actuators that control window openers and in-line duct fans and dampers. The system has different logic for different times of the year. In summer, when the temperature outside drops below a certain threshold compared to the temperature inside, the system is programmed to open high-level windows automatically and operate the fans and duct dampers so that hot air in the home is forced outside, while cooler air is drawn in through the windows. Paul notes that this is programmed to only happen in certain time periods—that although the temperature may drop low enough at 4am, you may not want the system to activate then as it's quite noisy opening the windows!

In winter, the KNX system is used to move warmth created by a wood heater (and some passive solar heat) to south-facing unheated rooms. KNX controls which in-line fans and dampers to turn on in the 300mm ducts, designed to move the air at high volume and slow speed (less feeling of draughts). The same system is used in summer to bring fresh air into the home via earth cooling tubes buried under the basement.

Paul notes that it can get as complex as you want (it's possible to spend $100,000 on a system which "automates everything"), but he's aiming to design a system that can be used by others to passively heat or cool their houses. With around 2km of wiring connecting six temperature sensors, eight duct actuators (dampers), three window actuators, and mechanical timers that can be overriden by the KNX controller, his system cost about $5000 to set up.

Both these homes are opening for Sustainable House Day this year, so why not go down and see the systems in operation! Find them at www.sustainablehouseday.com; Paul's house is '8.4 Star Cottage' in postcode 5067 and Leanne and Scott's is 'Melbourne Vernacular' in postcode 3013.