

# Home Automation S&T Notes

## OUTLINE

**What is home automation?** Well - not really defined officially anywhere. It generally involves automating domestic tasks of some sort but can be much more, as we will see. House building is very conventional hand has not really changed much in the last 50 years so home automation is something you add after a house is built rather than something you buy as part of the house.

## Recent developments

Home automation has emerged from the realm of geeks and specialised commercial experts to something that everyone can have go at - both from a cost and complexity point of view. I'm going to talk about some of these - particularly important as we all get a bit older and less sprightly.

**What do you need** - well I think I will address this as we go along - some things require a knowledge of basic electronics / coding and others are just off the shelf items

**My Home Automation** - I will use my own home automation system as an example as it contains a number of easy to implement items as well as some that are more complex but perhaps show what can be done.

My interest started a long time ago and there has been a procession of robotic items with various domestic functions - but heavily biased towards feeding cats.

## MY ROBOTS

My interest and history - Kay mentioned my ability to monitor and control our house in Cheltenham from Canada. This used the X10 network which ran over the mains. Had a number of drawbacks but was cheap.

## ROBOT VACUUM CLEANERS

Some items are off the shelf - one of these is the **Robot Vacuum Cleaner** - here is mine in action. These devices wander around the house scooping up dust and fluff. They can be programmed to set off at a scheduled time and they find their way back to their charging station at the end of the session or when the battery is getting low. Robotic lawn mowers are also available.

## RECENT DEVELOPMENTS

**Smart plugs and light bulbs** have made home automation much more accessible for the non-technical. The key change is that individual devices like light bulbs have their own identity and can be controlled remotely over wifi or similar. This is unlikely to be a passing trend - The Internet of Things envisages all devices being individually addressable. The world is becoming increasingly technical and we may benefit from this technology in our old age - provided we can master it first. Many are directly controllable from a phone over wifi - no other components required. Some devices require a hub which does the control and these are usually specific to one manufacturer's products - eg Philips Hue lights. There don't seem to be established standards to we have Betamax/VHS situation at the moment.

**Smart appliances** are now flooding the market - getting difficult to buy a fridge or oven or washing machine that does not offer a wifi enabled option. Not entirely clear why there is a great advantage in being able to control and monitor your washing machine remotely. Bosch Neff Hotpoint all offer

**Availability of cheap electronics** ie chips makes integration of connectivity much easier - the hard work has been done for manufacturers with a conventional approach to domestic electrical goods.

**Smart Assistants** like Alexa and Google Home have bypassed much of the need for buttons and switches by operating directly by voice control. Cost -£20-25 and apart from providing a voice access to Google search they can control most

smart devices. These devices are becoming ubiquitous and are clearly seen as important marketing tools. How do they work?

Voice input → voice recognition → restricted search engine → spoken answer or device control via product specific application.

### ***Smartphone integration***

- Many these devices rely on a smart phone app either for setup or control.

### ***MQTT***

Resurrection because it is an old protocol developed by IBM back in the days when networks were unreliable 1999. “Text messaging for computers”. Based around a broker which gathers and distributes messages on the basis of subscribed topics.

### **What are the components of a Home Automation System? - What do we need to build one?**

You can start small grow your system - my system has been built up over many years.

### **HARDWARE AND SENSORS**

Hardware needed for a full system

- Lights Z-wave and wifi
- 24/7 server
- Light and PIR movement sensors
- Cameras
- Door / gate sensors

### **SOFTWARE**

Not necessary to invest in a centralised software Home Automation system. All depends on what you want to do. Start with a phone and a few remote switches and bulbs. Generally does not need programming skills.

Problems of automating our lives

- Integration of technology with our normal living

### **My home automation**

- **HOMESEER**
  - Drivers that control devices such as lights, sprinklers, garage doors etc
  - Sensors detecting light levels, temperature movement etc
  - A rule based decision engine that allow you to create rule to control how and when devices operate
  - Includes web based reporting, notifications, direct control, creation of events which involve multiple devices
  - runs on a Raspberry Pi / Linux as well as Windows
  - Remote access via internet from anywhere
  - Web based control and status reporting

### **RASPBERRY PISTACK**

What does it look like?

### **VARIOUS SCREENS**

- Home screen
  - Device list + virtual devices
  - Device control
  - Activity icons
- Events list
- Rule example

### **ADDITIONAL FEATURES**

#### **Smart Driveway**

What does it do?

Cameras and image recognition 'video doorbell' Alternative to commercial video doorbells like "Ring"  
Uses OpenCV software and runs on a Raspberry Pi.

#### **EXAMPLE of DETECTION IMAGES**

- recognising a set of objects using neural networks which have been pre-trained.
- recognising a person is different from recognising who that person is
- Not influenced by other shapes around the person
- Can recognise multiple people or people and vehicles together
- Transmits a thumbnail of the image to a phone
- Alerts me to the presence of someone on the drive

#### **ALERTING**

##### **Voice and Visual**

- MQTT alert on phone
- Status flagged on Homeseer main screen
- Voice output through a speaker

#### **VOICE TEXT TO SPEECH**

- Polly TTS on RPi speakers

Also works for other sensors like

- Garage door sensor
- Side Gate sensor
- Rubbish collection day alert

#### **PLANT MONITORING**

Edward Yuccaplant

- Explanation of what it does/ hardware / software

- NTP time acquisition
- Example emails received
- Photos of Edward
- Soil moisture sensor - resistive

#### **SELF WATERING**

- Explanation of what it does/ hardware / software
- MQTT control and reporting
- Reservoir management
- Video of the watering in action
- Soil moisture sensor capacitive

#### **BLINDS CONTROL**

#### **SMART PARCEL BOX**

- Why have a parcel box?
- What does it do?
  - detects parcels in the box
  - LCD Display
  - Sends notifications to my phone and emails
  - Notifies Homeseer
  - MQTT control and notifications
- Display
- Lock
- Ultrasonic parcel detection
- Integration with Homeseer

#### **PARCEL BOX REPORTING AND CONTROL IMAGES**

#### **FUN THINGS**

Bubbles and Dickens

#### **Bubbles**

- Video of bubbles in action

#### **MacDuff**

The future of home automation ?

- MacDuff photos
- MacDuff Video
  - voice control

#### **THE ROBOT KITCHEN**

Video