Control Systems

RIBA Part 1 Year 3 Lecture
LSBU 2016/17

- Semester 1, Technology 2
- (i.e. Bachelor BA3 students) Part 1 Year 3
- Monday 17 October (11.00-13.00am) Room T214
- Tutor: Andrew Stoane
- Andrews brief to me:

So far I have given 3rd year 2 lectures.

- The first was a broad introduction to tectonic thinking and particularly how the detail scale becomes part of a design argument, but also how technologies, processes and techniques become part of a cultural mode.
- Maybe you could somehow contextualise how control systems and consideration of environmental sustainability has become part of our modern world.

Jargon Busting Tectonic thinking

- defined as a central attention towards the nature, the properties, and the application of building materials (construction) and how this attention forms a creative force in building constructions, structural features and architectural design (construing) – helps to identify and refine technology transfer in contemporary industrialized building construction'

Jargon Busting: Mode

- Mode (statistics), the most common value among a group

Jargon Busting: Control System

- A control system is a device, or set of devices, that manages, commands, directs or regulates the behavior of other devices or systems.
- They can range from a home heating controller using a thermostat controlling a boiler to large Industrial control systems which are used for controlling processes or machines.

My response:

- What is your definition of control systems?
- Science, physics, mathematics, Global, regional, national targets, Directives, Legislation, Regulation, Development Control, Professional Practice, Education, Cultural Morals, Consumer pressure, Standards, Codes of Practice
- or all of these or none?

Andy's response

- Control systems:
- I was specifically thinking of automated building systems but this will obviously overlap with many bigger connected fields, particularly regulatory and legislative … maybe even moral.
- Please feel free to make this specific or to expand into broader associated cultural / sociological territory as you see fit.
- The lecture:

Control Systems

- Control systems are reliant upon:
- Human interaction
  - (flick a switch, control a smart phone)
- Automatic instruction
  - (computer programme or pre-programmed instruction)
- Automatic monitoring, detection and actuation
  - (person in corridor detected and light instructed to turn on)

Internet of Things

- More than wi-fi capable printing
- Appliances equipped with chip and wi-fi capability
- Controllable by smart-phone app or via internet
- Permits remote control within or without the building
- Turn the heating on before you arrive so the temperature is comfortable just as you arrive
- Allows appliances to react with each other washing machine triggered by the radio reporting low tariff power

In the home:

- New upmarket houses pre-wired with ITC services
- Home entertainment
  - (Hi-fi, TV, music, video, cinema) Noisy neighbours
- Home security
  - (CCVT, central locking, detection, alarm)
- Computer system
  - (server, outlets in all rooms and wi-fi)
- Central server and delivery to any/many room(s) at the same time
- Presence detection and delivery to your location as you move
  - (crush pin in lapel detected)

Voice actuation

- Integer House BRE Campus Bathroom Controls
- Voice actuated taps that are controlled by computer
- It recognizes your voice and runs the bath to the temperature and depth you prefer.

Voice actuated Lifts

- Bryan Avery 9 storey 9 room house
- Linear induction motor lift
  - (very fast empty)
- Voice activated lift cab
- Call the lift and it arrives as you do
- Tell it which floor you require and it goes there
- But some rooms may be out of bounds and it won't go there if your voice clashes with a room ownership
- Recognizes your voice and accelerates and travels at your preferred speed

What else should be possible:

- At the door as you leave
- Check local bus service arrival times to allow choosing the bus over the car

Variable Message signs

- Bus stop countdown screen
- Underground platform countdown screens
- Railway platform count down screens

Streetlights

- Avoid clocks because they can be set 12 hours adrift
- Some LA turn many lights off to save energy
- To pay for the ones they leave on in the day
- Daylight detectors
  - Detect low levels of light and turn lights on
  - Rain clouds can turn them on

Travel to Work:

- Motorways (M25 west)
- Overhead gantry with variable speed for added capacity, with controls and variable message signs

Entering a town

- Car park capacity variable message signs
- Variable Message Signs indicating spaces in various car parks to redirect to avoid queues

Traffic lights

- Cameras monitor approaching vehicles and start light signal cycle to clear traffic,
- Absence of vehicles can leapfrog steps of the sequence
- Some cameras are not sensitive enough or cars are out of sight and reversing or waving can wake them up
- Cyclist may not be seen by camera

Shopping centre multi-storey car park

- Has 1000 lights on all night after the car park is shut
- Planned improvements
- Now want to add red and green lights to indicate car parking bay availability
- Now another 2000 lights to be added
- Red lights if occupied and green light if vacant
- 1000 green lights ad 1000 white lights left on all night when car park empty

Consolidation Centre lorry loading dock lights

- Green lights to show a vacant dock but the absence of a lorry says that already
- Green light could be turned on to invite the lorry to the specific dock,
  - but they are all on all the time the dock is empty
- Red lights to show an occupied dock
  - but the presence of a lorry says that already
- Green light could turn to red once the lorry is engaged to tell the driver to turn off engine and hand break on.
- Red light could be turned off when there is no action occurring.

The power of open access big data

- Underground, Oystercard and London 2012
- When the Olympics came along there was a real risk of over crowding due to domestic and international visitors to the games and to the city using the same system that delivers the workers and difficulties could have arisen.
- The Underground had for a long time been modeled for train movement optimization but without passengers
- But passengers could not be modeled due to unknown and unpredictable movement of any individual

Then along came the Oystercard,

- in advance of the Olympics and everything changed
- Every individual oyster card represents an individual person
- Monitoring transactions of the Oystercard discovers the timing(s) and route(s) of the individual
- Looking at many Oystercard transactions discovers the timing(s) and route(s) of London's working population
- The majority (a very significant %) of which have a regular pattern of movement on the network
- Every day they arrive at a terminal station enter the underground, use the same route to work and retrace their track in the evening.
- Occasionally they may do something different but the majority of the time it is predictable.

Now modeling of the majority of passengers

- in the underground is also possible.
- So optimization of train journey to better match predictable passenger flow, quantities and times
- Now, linking the Olympics ticket sales to Oystercard ticket sales means the regular underground users that purchase games tickets can be remodeled, deleting their work route and adding their games route, their modified journeys can be now be modeled in the system.
- International visitors using oyster entering the underground system near their hotels can also be linked to games tickets and journeys planned.
- Now the whole system and the slugs of people can be modeled and pushed round the system, bottlenecks identified and more frequent trains can be directed to clear them.
- If you travelled on the underground during the games you may have experienced the lack of problems.

Underground Tunnel layouts and passages between

- Signage directs you the longest route
- to spread the passengers out and slow them down
- to reduce congestion and bottlenecks
- Those in the know short cut

Door actuation Proximity detection

- Infrared detectors are aware of approaching pedestrians
- instruct the door ironmongery to open the door in time for the pedestrian to enter without slowing or speeding up.
- The same willalso happen at the inner doors of the same lobby.
- The speed of the pedestrian will bring them to the inner lobby doors and open them whilst the outer doors have not yet closed,
- destroying the purpose of the doubled lobbied door and letting the wind howl in.

Door Actuation Touch detection

- The British Library reading rooms have door ironmongery of bronze handles with leather bindings one set has a copper thread running parallel with the leather bindings.
- When a visitor or librarian holds the door handle they complete an electrical circuit that triggers the door actuator to open the door

Foot Traffic Detection

- Trains internal vestibule doors
- Footfall adjacent to the doors will trigger the doors to open
- Continuous weight on the floor should stop the door closing but somebody saved a bit of money or forgot this.

Lifts banks in Towerblocks

- Canary Wharf Towers
  - 10,000 occupants plus visitors, 50 storeys, 2600 m2/floor, ±200 people/floor, 32 passenger lifts, 40 seconds ground floor to roof level
- Lifts know where to go once you have told them which floors you want
  - (see: Voice actuation later)
- If a lift with say 20 passengers stops at any floor anywhere in 50 storeys
  - then the service would be slow and cause bottlenecks
- There are 4 lift banks clustered around the core
  - potentially serving each corner of the building
- Each lift bank has 4 lifts facing 4 more,
  - (32 in all, plus fireman and goods, VIP lifts)
  - these lifts go fast to the first of a range of floors avoiding floors below
  - then serves its range of floors as buttons are pressed by passengers
- This reduce the numbers of stops and increase speed of delivery of those passengers
- Passengers are directed to the correct lift bank by signage in the lobby and their journey is swift.
- Passengers having pressed the call button are attracted to arrived lifts by bells as normal.

Temperature Controls

- Office Campus Greenpark Reading
- Designed by Norman Foster has a visitors centre where RIBA SE holds CPD.
- The Facilities Manager has a member of staff full-time taking phone calls from staff asking for different room temperatures, they log the call and adjust the temperature using M&E controls to adjust the air temperature.
- This goes on all day, no doubt the 10th call undoes the work of the 1st call and the cycle begins again.

Temperature Controls

- Inland Revenue Office Nottingham
- Designed by Hopkins
- The facilities manager explained that staff are given a hand-held infrared controller to adjust the air temperature in their vicinity, raising or lowering their desired temperature.
- If every member of staff has a different preferred temperature, then conflicting IR messages will clash and probably ovehwhelm the system with confusing instruction.
- Males and female staff have different dress codes and different body temperature needs
- Now the staff have a controller that flashes but does nothing to the controls but gives the staff a false impression of having some control
- The lightweight top floor roof overheats the top floor occupants and little can be done about it apart from reinsulating the roof with the correct insulation properties for the conditions.

Ventilation Control

- BRE Environment Building
- Ventilation shaft on South elevation
- Connected to and ventilates the floor void
- Once the temperature reaches preset level
- Valve at top opens and releases the hot air inside drawing hot air from floor void
- Opaque windows at floor edge act as vents to floor void

Sunlight Controls

- British Library Reading room rooflight solar shading
- Readers in reading rooms want daylight without the glare of sunlight, and rare books collections do not want high levels of ultraviolet light entering or they fade the books
- Solar shading set on pivots and controlled by actuators mounted on frames above greenhouse rooflights
- The blades are controlled by computer to drive actuators that adjust the angle of the solar blades to maximize the daylight entry and minimize the sunlight entry and bounce the light off surfaces so the UV light is absorbed.
- Sunlight detection outside and daylight detection inside are brought together by software which also knows the time of day and day of the year, the software has the capacity to learn for every day of the year the optimum position of the solar shading blades and modify this according to the weather, sunshine and clouds.

Environment Building BRE Campus

- Interger Building BRE Campus
- The lean to greenhouse has internal louvered blinds following the line of the sloping glass
- There was (and still is?) an internet controller that allow visits to open or close the blinds.
- The stupidity of giving controls to anybody to remotely mess up the energy performance of the building is real.

Lighting Controls

- Room ownership
- Storage cupboard belongs to nobody
- You enter with hands full
- No hands free to turn lights on
- Exit leaving with more hands full
- No hands to turn off the light
- This needs to be an automatic light

Office Floor

- Desk areas nearest the windows do not need lights on in day
  - (daylight sensors or seasonally adjusted clock)
  - but do need light at night
- Lights should go off at lunchtime and end of business
  - And manually turned back on after lunch and by later workers
- Natural England add string pull switches over work spaces
  - Staff who care (all of them) use the string pull always

WC

- Stickers say turn off the light as you leave
- But you do not own the space
- And you may not be alone
- The silent sitter will be in darkness if you turn off the lights
- The room should turn its lights off when vacant
- And silent sitters should reactivate it
- Many hands make light work

Last person out

- Last person leaving the floor turn on security
  - Turn off lights enter lifts
  - Trained to do it
- Cleaners enter floors and turn them on
  - But not obliged to turn off upon completion
  - Specify it in contracts
- Security enter unlit floors, lights on
  - Time delay 1 hour and turn off
  - Security roster every hour
  - Lights on 24 hours of day

Lights on emergency staircase

- Lights in emergency stairs are often on 24 hours of the day
  - Need to be on a clock
  - Off out of office hours
  - PIR detectors turn on if staff present
- External stairs are often on 24 hours a day
  - Need to be on a clock or daylight detectors
  - Should only come on in an emergency in hours of darkness
- Lights on stairs can be on timed switch with delayed off

Controls with attitude

- I turn the oven on and set it at highest temperature under the false illusion that it will get hotter quicker
- If we do this with heating systems we can squander heat unnecessarily
- Controls with attitude will:
  - slap our wrists and
  - tell us 'just be patient'
  - stop sending me conflicting instructions,
  - I will deliver what you asked for
  - and let you know when I get there
- This is probably the best way to learn

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