TRECO-office

Analysis of the occupant behaviour influences on the energy consumption of an office building with low-cost sensor-based techniques.

> influence of occupant behavior on total energy consumption

The impact of occupant behaviour in office buildings on the total energy consumption is one of the aspects that is not clearly defined and understood. A research at the ABT office has been conducted to discriminate the occupant related influences from other factors (building and installation characteristics and climate conditions).

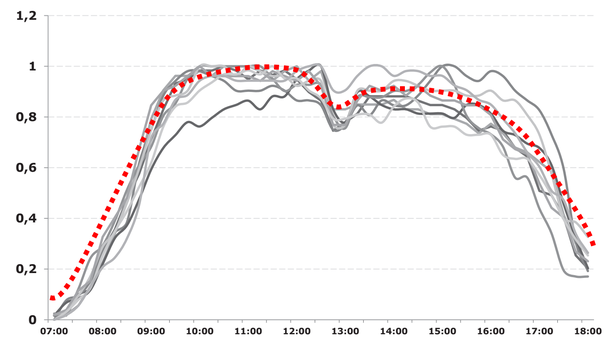
ABT office

The normalized trend displays a morning peak at 10:00. After the peak the occupancy related electricity consumption gradually declines (graph a). The declination is steeper as the declination in occupancy behaviour (graph b).

Suggesting that this consumption of electricity is not entirely related to the number of occupants in the building, it suggests a strong correlation in the morning though after the morning the electricity shows regression (graph c).

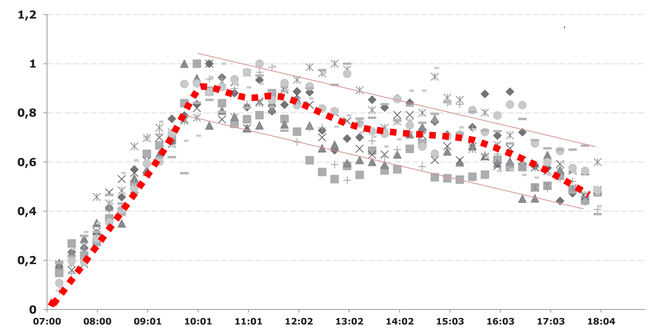
This might be caused that only a part uses electricity for their productivity all day (computer + screen) whilst another part has their laptop on standby due to meetings. The simultaneous demand of electricity consumption is higher in the morning as later in the day as well due to daily routines.

daily normalized occupancy behaviour



graph a

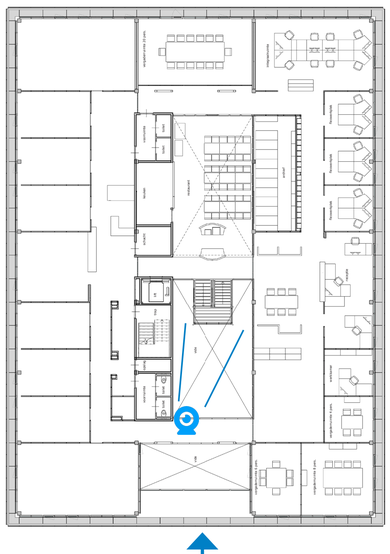
daily normalized occupancy related electricity behaviour



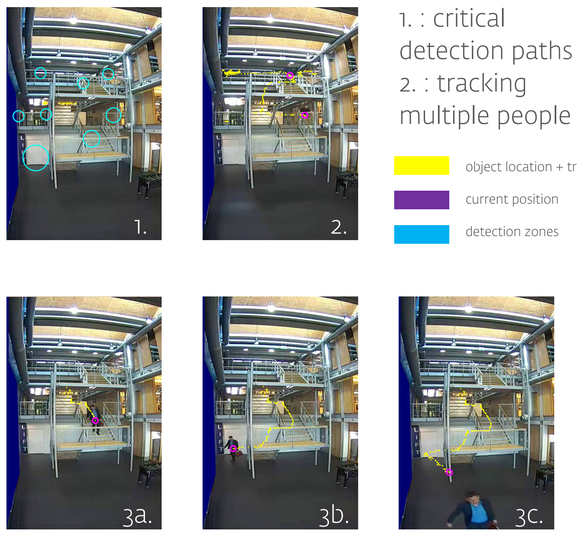
graph b

> occupant movement detection and tracking

A low cost camera is used in order to be able to monitor the behaviour of the occupants throughout the day. Motion of each of the occupants is detected and tracked throughout the space. Data is logged to a text file once certain tracked paths of interest are completed by the occupants.



ABT office plan



1. : critical detection paths
2. : tracking multiple people

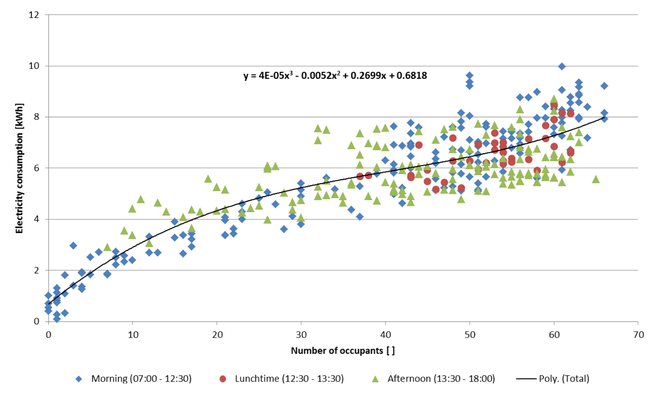
object location + tracking
current position
detection zones

3. a-c :dynamic tracking of a person

	entrance	stair 1	level1 right	level1 left	level 1 2nd left	star 2	level 2 right	level 2 left
entrance								
stair 1	99		26	57		51		
level1 right		39		18		43		
level1 left		18	55		50	46		
level 1 2nd left				44				
star 2		66	33	37			64	93
level 2 right						61		15
level 2 left						102	14	

tracking matrix with detection of persons within different zones

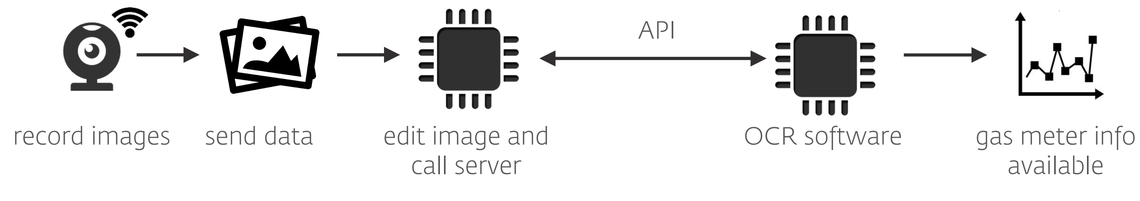
occupancy vs. electricyty consumption



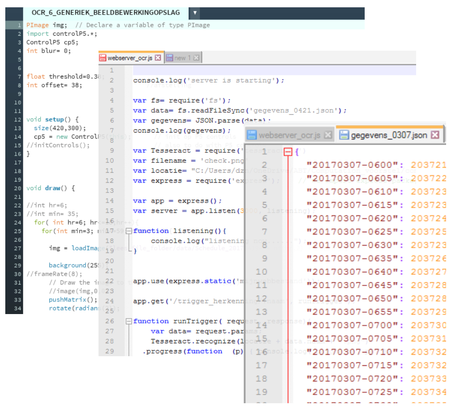
graph c

> automated gas meter reading

The gas meter consists out of an analogue readout. A camera captures a photo every ten minutes which is streamed to a server. Via its API (Application Programming Interface) a direct translation is achieved and logged to a text file throughout the day in order to monitor the gas consumption.

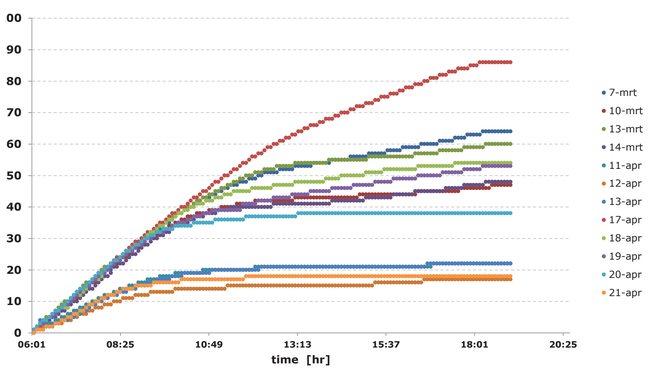


recoring of the images



images are edited and sent to server

daily gas consumption



> The monitored data have been analysed and compared to the simulated data. Based on the measurements simplified algorithms have been developed to describe the relation of the occupant related actions and the energy use in this building. Implementations of these algorithms into the simulation models show a fairly accurate prediction of the total energy consumption of the office building.

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