Computational conceptual modelling and requirements capture: a systems approach.

The Dagstuhl Case Study.

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Appendix.

This appendix should be read in conjunction with the full paper.

Basic functions.
We define the various process functions, all of which update the room system clock.
- **enter** which detects someone entering the room (imd1 occurs) and reads the memory for the
light scene setting, switches the light scene on and refreshes the status (memory) and display [ref 1.2] (what about dcc1 and dcc2 - what do these actually tell us?)

**buttons:** this represents the following five specific functions:

- **wall_switch** which is the operation of the wall ceiling switch and the adjustment of the light scene and status by changing the ceiling light and display [ref 1.5]
- **window_switch** which is the operation of the wall switch and the adjustment of the light scene and status by changing the window light and display [ref 1.5]
- **task_light** which is the operation of the task light switch and the adjustment of the light scene and status and display [ref 2.3(i)]
- **sw_off** which is a process that waits for T3 time units and then switches off the lights, it updates the clock after every time unit.
- **still_occupied** is a process that maintains the settings in the absence of user alterations (other functions), it just passes the time, updating the clock every time unit.

- **begin_control** a command that starts a user interaction using the control panel (if there was a security issue it would begin with a password or PIN and these would have to be stored in the memory as well as the other information).
- **edit_control** a generic high level function that will be refined later when the precise functionality of the control panel was established. This would include functions to set ambient light levels and to dim various combinations of lights.
- **end_control** a command signifying the conclusion of the control panel interaction and confirmation of the new settings.
- **report** is the communication request for information from the FM system. It causes the system to enter a communicating state.
- **clock_sync** ends the communication processing if the room is still occupied.
- **set_sync** ends the communication processing if the user has left the room in the process of the communication (by referring to the memory value).
- **exit** detects that all occupants have left the room.

The full test set for the X-machine in Fig. 4.1.

**GENERALISED MACHINE:**

```plaintext
C = (4 elements)
   { Generalised_machine: } { Generalised_machine:enter } { Generalised_machine:report }
   -------------------
   { Generalised_machine: }
   -------------------
   { Generalised_machine: } { Generalised_machine:enter }
   -------------------
   { Generalised_machine: } { Generalised_machine:report }
   *******************************************
W = (3 elements)
   { Generalised_machine:enter }
   -------------------
   { Generalised_machine:set_sync }
   -------------------
   { Generalised_machine:clock_sync }
   *******************************************
```
\[ \Phi = \{ \text{7 elements} \} \]

\[
\begin{align*}
\{ & \text{Generalised\_machine:enter} \} \\
\{ & \text{Generalised\_machine:buttons} \} \\
\{ & \text{Generalised\_machine:set\_sync} \} \\
\{ & \text{Generalised\_machine:report} \} \\
\{ & \text{Generalised\_machine:exit} \} \\
\{ & \text{Generalised\_machine:clock\_sync} \} \\
\{ & \text{Generalised\_machine:user\_adjust} \}
\end{align*}
\]

Test set (difference = 0)
contains 35 sequences
\[
\begin{align*}
\{ & \text{Generalised\_machine:} \} \{ \text{Generalised\_machine:enter} \} \{ \\
\text{Generalised\_machine:report} \} \{ \text{Generalised\_machine:enter} \} \\
\{ & \text{Generalised\_machine:} \} \{ \text{Generalised\_machine:enter} \} \{ \\
\text{Generalised\_machine:report} \} \{ \text{Generalised\_machine:set\_sync} \} \\
\{ & \text{Generalised\_machine:} \} \{ \text{Generalised\_machine:enter} \} \{ \\
\text{Generalised\_machine:report} \} \{ \text{Generalised\_machine:clock\_sync} \} \{ \\
\text{Generalised\_machine:enter} \} \\
\{ & \text{Generalised\_machine:} \} \{ \text{Generalised\_machine:set\_sync} \} \\
\{ & \text{Generalised\_machine:} \} \{ \text{Generalised\_machine:clock\_sync} \} \\
\{ & \text{Generalised\_machine:} \} \{ \text{Generalised\_machine:enter} \} \{ \\
\text{Generalised\_machine:report} \} \{ \text{Generalised\_machine:enter} \} \{ \\
\text{Generalised\_machine:clock\_sync} \} \\
\{ & \text{Generalised\_machine:} \} \{ \text{Generalised\_machine:clock\_sync} \} \\
\{ & \text{Generalised\_machine:} \} \{ \text{Generalised\_machine:report} \} \\
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\text{Generalised\_machine:} \} \{ \text{Generalised\_machine:enter} \} \{ \\
\text{Generalised\_machine: report} \} \{ \text{Generalised\_machine:enter} \} \{ \\
\text{Generalised\_machine:report} \} \{ \text{Generalised\_machine:exit} \} \\
\{ & \text{Generalised\_machine:} \} \{ \text{Generalised\_machine:enter} \} \{ \\
\text{Generalised\_machine: report} \} \{ \text{Generalised\_machine:clock\_sync} \} \\
\{ & \text{Generalised\_machine:} \} \{ \text{Generalised\_machine:clock\_sync} \} \\
\{ & \text{Generalised\_machine:} \} \{ \text{Generalised\_machine:enter} \} \{ \\
\text{Generalised\_machine:} \} \{ \text{Generalised\_machine:} \} \{ \\
\text{Generalised\_machine:report} \} \{ \text{Generalised\_machine:clock\_sync} \} \\
\{ & \text{Generalised\_machine:} \} \{ \text{Generalised\_machine:clock\_sync} \} \\
\{ & \text{Generalised\_machine:} \} \{ \text{Generalised\_machine:enter} \} \{ \\
\text{Generalised\_machine:} \} \{ \text{Generalised\_machine:} \} \{ \\
\text{Generalised\_machine:report} \} \{ \text{Generalised\_machine:} \} \{ \\
\text{Generalised\_machine:report} \} \{ \text{Generalised\_machine:user\_adjust} \} \\
\{ & \text{Generalised\_machine:} \} \{ \text{Generalised\_machine:} \} \{ \\
\text{Generalised\_machine:} \} \{ \text{Generalised\_machine:report} \} \\
\{ & \text{Generalised\_machine:} \} \{ \text{Generalised\_machine:} \} \{ \\
\text{Generalised\_machine:} \} \{ \text{Generalised\_machine:exit} \}
\end{align*}
\]
Test set (difference = 1)
contains 87 sequences

```
( Generalised_machine: report ) { Generalised_machine: user_adjust }
( Generalised_machine: set_sync ) { Generalised_machine: report }
( Generalised_machine: clock_sync ) { Generalised_machine: report }
( Generalised_machine: exit ) { Generalised_machine: report }
( Generalised_machine: user_adjust ) { Generalised_machine: enter }
( Generalised_machine: set_sync ) { Generalised_machine: enter }
( Generalised_machine: clock_sync ) { Generalised_machine: enter }
```

...
C = (5 elements)
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{ Office_machine: } { Office_machine:report }
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{ Office_machine: } { Office_machine:report }
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{ Office_machine: } { Office_machine:report }
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{ Office_machine: } { Office_machine:report }
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{ Office_machine: } { Office_machine:report }
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\[ W = (4 \text{ elements}) \]
\[
\begin{align*}
\{ & \text{Office machine: enter} \} \\
\{ & \text{Office machine: edit control} \} \\
\{ & \text{Office machine: exit} \} \\
\{ & \text{Office machine: clock sync} \}
\end{align*}
\]

\[ \Phi = (9 \text{ elements}) \]
\[
\begin{align*}
\{ & \text{Office machine: enter} \} \\
\{ & \text{Office machine: set sync} \} \\
\{ & \text{Office machine: begin control} \} \\
\{ & \text{Office machine: end control} \} \\
\{ & \text{Office machine: edit control} \} \\
\{ & \text{Office machine: exit} \} \\
\{ & \text{Office machine: report} \} \\
\{ & \text{Office machine: clock sync} \} \\
\{ & \text{Office machine: buttons} \}
\end{align*}
\]

Test set (difference = 0)
contains 62 sequences
\[
\begin{align*}
\{ & \text{Office machine: enter} \} \{ \text{Office machine: begin control} \} \\
\{ & \text{Office machine: enter} \} \\
\{ & \text{Office machine: enter} \} \{ \text{Office machine: begin control} \} \\
\{ & \text{Office machine: enter} \} \{ \text{Office machine: begin control} \} \{ \text{Office machine: enter} \} \\
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\{ & \text{Office machine: enter} \} \{ \text{Office machine: begin control} \} \\
\{ & \text{Office machine: enter} \} \{ \text{Office machine: begin control} \} \{ \text{Office machine: report} \} \{ \text{Office machine: enter} \} \\
\{ & \text{Office machine: enter} \} \{ \text{Office machine: begin control} \} \{ \text{Office machine: report} \} \{ \text{Office machine: enter} \} \{ \text{Office machine: report} \} \{ \text{Office machine: edit control} \} \\
\{ & \text{Office machine: enter} \} \{ \text{Office machine: begin control} \} \{ \text{Office machine: report} \} \{ \text{Office machine: report} \} \{ \text{Office machine: exit} \} \{ \text{Office machine: clock sync} \} \{ \text{Office machine: report} \} \{ \text{Office machine: edit control} \} \\
\{ & \text{Office machine: exit} \} \{ \text{Office machine: clock sync} \}
\end{align*}
\]
Test set (difference = 1) contains 160 sequences:

```plaintext
(Office_machine: ) (Office_machine:enter) (Office_machine:report)
(Office_machine:end_control)
(Office_machine:report)
(Office_machine:report)
(Office_machine:clock_sync)
(Office_machine:exit)
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