IDDIS Coursework

David Halliday

CS4

2004

01012588

1. Design

1.1.User Profiles & Functionality Requirements

1.1.1.Disabled – Quadriplegic (Wheelchair)

Characteristic	Attribute	Requirement Implied
Sex	Male + Female	The system must appeal to both men and women alike.
Age Range	16 +	The system must deal with a wide age variety (mainly mature) giving clear information is important.
Frequency of use	Several times a day	The system must be fast to use otherwise it will be a hassle.
Computer Experience O/s Applications	All users will be familiar with IBM and IBM compatible hardware running a windows operating system and applications	The system must maintain the look and feel of the operating system it is used in (Windows) it must also use similar style functions and utilities to other applications on that operating system.
Other Systems Used	A variety of windows applications including: Office applications, Internet Applications	
Language/ Education	All users will have to have basic computer skills (use mouse, keyboard and basic windows functions)	Users will not understand complicated technical language so technical language must be kept low. Also ambiguity can't be an issue so in some cases small amounts of technical language may be required so as to not confuse a user.
Language Skills	All users will understand English language	
Significance of disability	A wheelchair bound person is not generally mentally disabled. A wheelchair bound person is unable to easily move round the house to make changes to things in the same way an able bodied person is.	The software itself does not need to be heavily adapted for a wheelchair user for the interface. However the system is best used in a way that the user does not have to be in one place to control the house. This can be overcome by use of a tablet PC with wireless networking.

1.1.2. Disabled – Deaf

Characteristic	Attribute	Requirement Implied
Sex	Male + Female	The system must appeal to both men and women alike.
Age Range	16 +	The system must deal with a wide age variety (mainly mature) giving clear information is important.
Frequency of use	Several times a day	The system must be fast to use otherwise it will be a hassle.
Computer Experience O/s Applications	All users will be familiar with IBM and IBM compatible hardware running a windows operating system and applications	The system must maintain the look and feel of the operating system it is used in (Windows) it must also use similar style functions and utilities to other applications on that operating system.
Other Systems Used	A variety of windows applications including: Office applications, Internet Applications	
Language/ Education	All users will have to have basic computer skills (use mouse, keyboard and basic windows functions)	Users will not understand complicated technical language so technical language must be kept low. Also ambiguity can't be an issue so in some cases small amounts of technical language may be required so as to not confuse a user.
Language Skills	All users will understand English language	
Significance of disability	A deaf user will not benefit from audio output from a programme A deaf person will require notification of status of items throughout a building as they will be unable to tell by sound if say a TV is left on.	No audio output is to be used in the application.

1.1.3.Disabled – Quadriplegic (Other)

Characteristic	Attribute	Requirement Implied
Sex	Male + Female	The system must appeal to both men and women alike.
Age Range	16 +	The system must deal with a wide age variety (mainly mature) giving clear information is important.
Frequency of use	Several times a day	The system must be fast to use otherwise it will be a hassle.
Computer Experience O/s Applications	All users will be familiar with IBM and IBM compatible hardware running a windows operating system and applications	The system must maintain the look and feel of the operating system it is used in (Windows) it must also use similar style functions and utilities to other applications on that operating system.
Other Systems Used	A variety of windows applications including: Office applications, Internet Applications	
Language/ Education	All users will have to have basic computer skills (use mouse, keyboard and basic windows functions)	Users will not understand complicated technical language so technical language must be kept low. Also ambiguity can't be an issue so in some cases small amounts of technical language may be required so as to not confuse a user.
Language Skills	All users will understand English language	
Significance of disability	A general Quadriplegic person may have one of a variety of impairments on their ability to control/move objects around them. For this there are a large number of items around to help them interact with computers many of which control pointing devices.	The application must be able to be 100% pointer orientated for day to day use.

1.1.4.Functionality

X10 Devices

The system will primarily be based on the X10 device controlling procedures. X10 uses the existing wiring in a house to send control signals to and from devices. The only thing these signals can do is turn a device on or off. Obviously using this cleverly can achieve other sections for example curtains can be controlled by saying "on" is for open and "off" is for shut.
X10 items are identified in a house using two separate 4 bit numbers giving a total of 256 different items that can be controlled in a house. These are called house no. and item no. (Originally so that individual houses would not conflict but because of the slow uptake in the UK it is not overly important to worry about the house code).
So in short all X10 items only need to be turned on and off.

Disabled User Input

Because the programme has to be used by a variety of disabled users who could be using any number of different peripherals for controlling a computer system including (but not limiting):

- Voice recognition
- Touch Screen
- Blow Pipe
- Joy stick
- Head/eye motion detector

Most of these peripherals control the pointer functions on the computer. Or in the case of the voice recognition have the ability to control the pointer.

Remote Controlling

As disabled users alike aren't able to be where the item they are controlling is. Because of this the system has to be able to be controlled from anywhere. The best way to achieve this is to have a centralised server that is directly in control of all the appliances in the building which can be controlled remotely with wireless home networking using a tablet PC.

Easy and self explanatory GUI

The user interface has to be self explanatory and not needlessly cluttered to avoid confusing the user.

Fast accessibility to functions

Disabled users may have complex peripherals that make doing even simple mouse operations difficult and time consuming and thus require a minimal number of actions required for each functionality.

Fonts and Colours

It is possible in MS Windows™ to configure your own "theme" which includes the colour scheme and default fonts to be used by applications, part of this is for usability in the case of users who for example are colour blind or find they need larger fonts or in the case of dyslexics different colour schemes are easier to read than others.

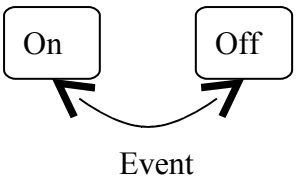
Usability Design Aims

The system needs to have the following usability functionality in it so that it is easy to use and flexible:

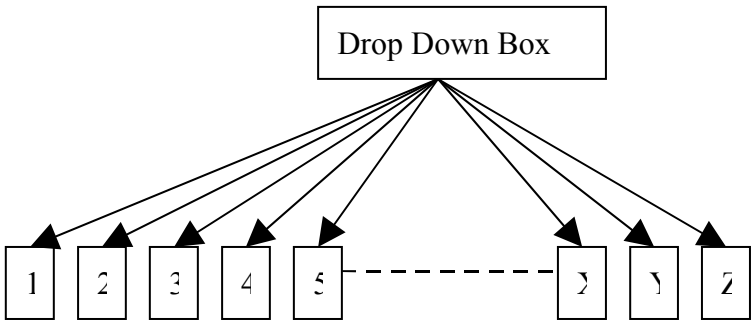
- Entirely Pointer driven – The system can be entirely controlled (but not necessarily configured) using pointing devices
- Fast access of functionality – All common tasks are to be accessible within "3 clicks"
- Inherit existing colour and font settings – Use the users existing windows™ colour and font settings for the GUI
- Allow for custom colour and font settings – The system must allow for its own customisable settings if the user does not wish to use the same settings they have for the rest of their operating system.

1.2. State Transition Diagrams & Storyboards

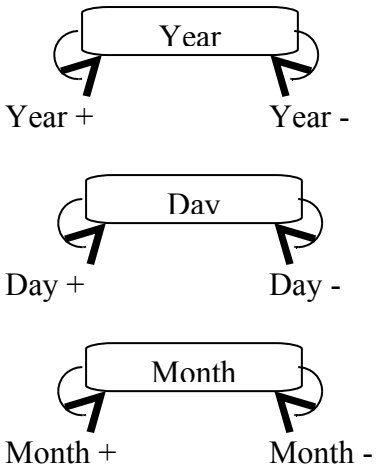
1.2.1.X10 Appliances Change Status



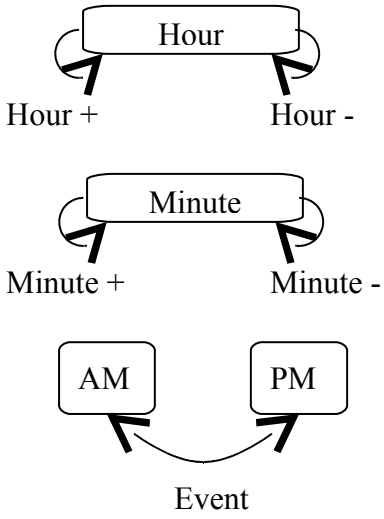
1.2.2.Numbers (small limit) Select



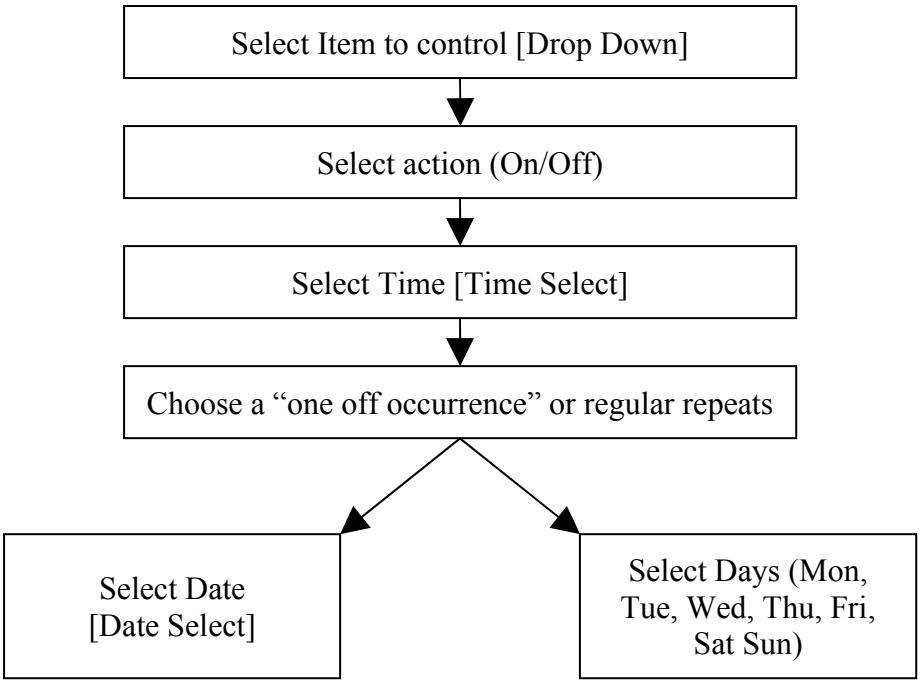
1.2.3.Date Select



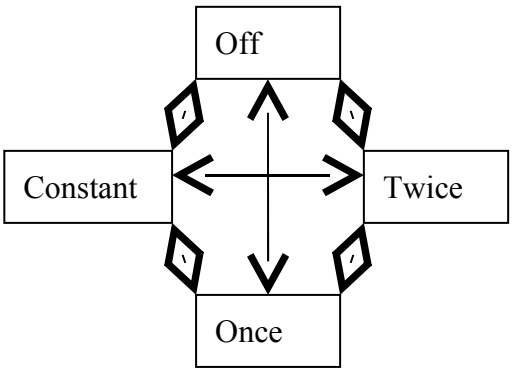
1.2.4.Time Select

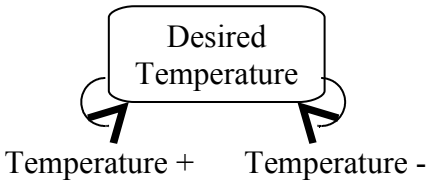


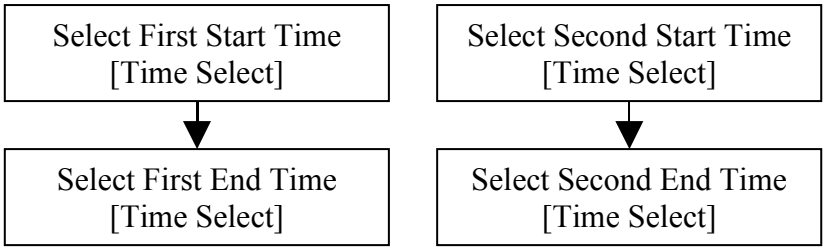
1.2.5.Timer



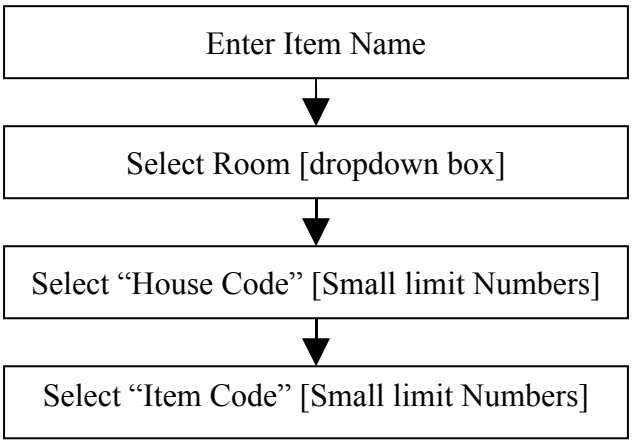
1.2.6.Heating





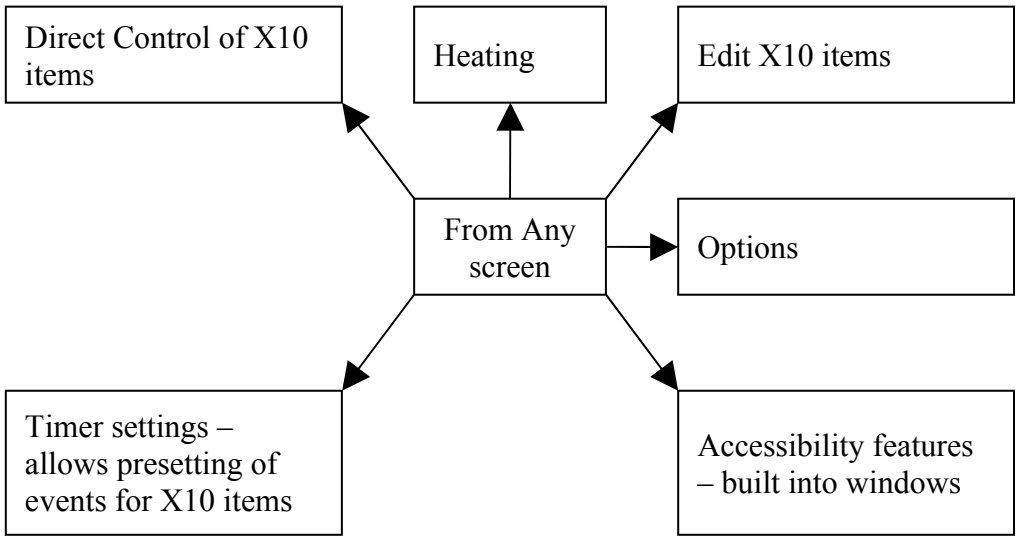


1.2.7.X10 Item editing



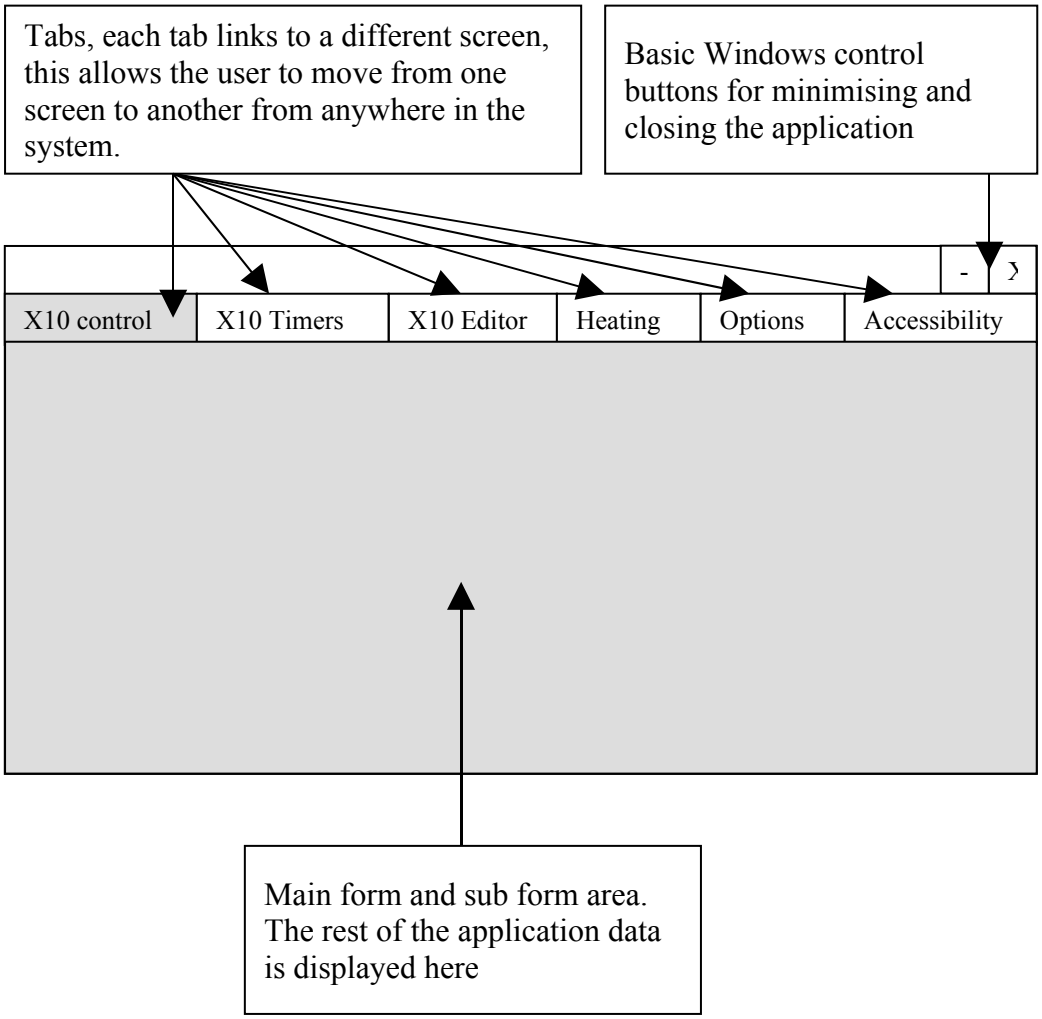
1.2.8.System flow

Basic system organisation



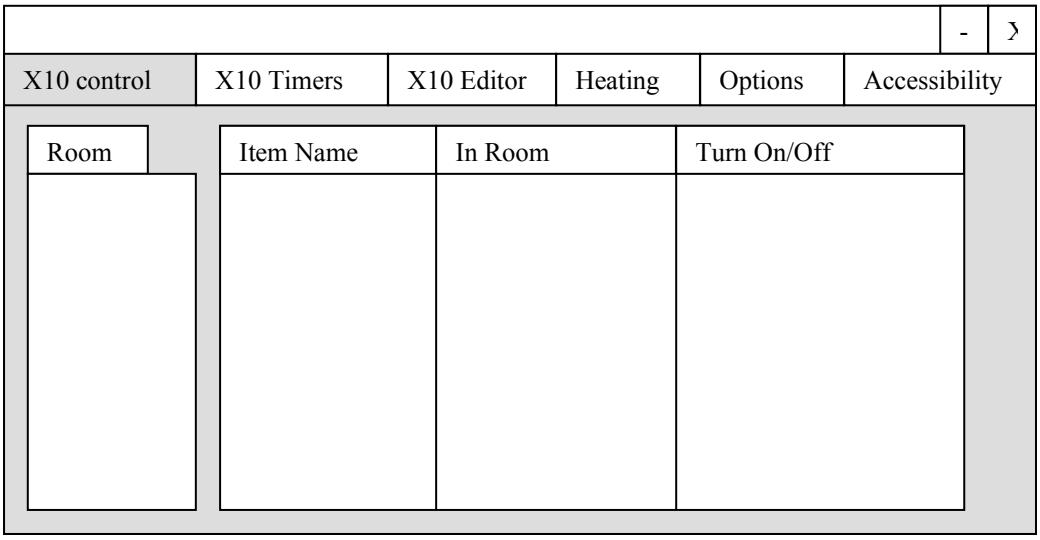
1.2.9.Storyboard

Main System



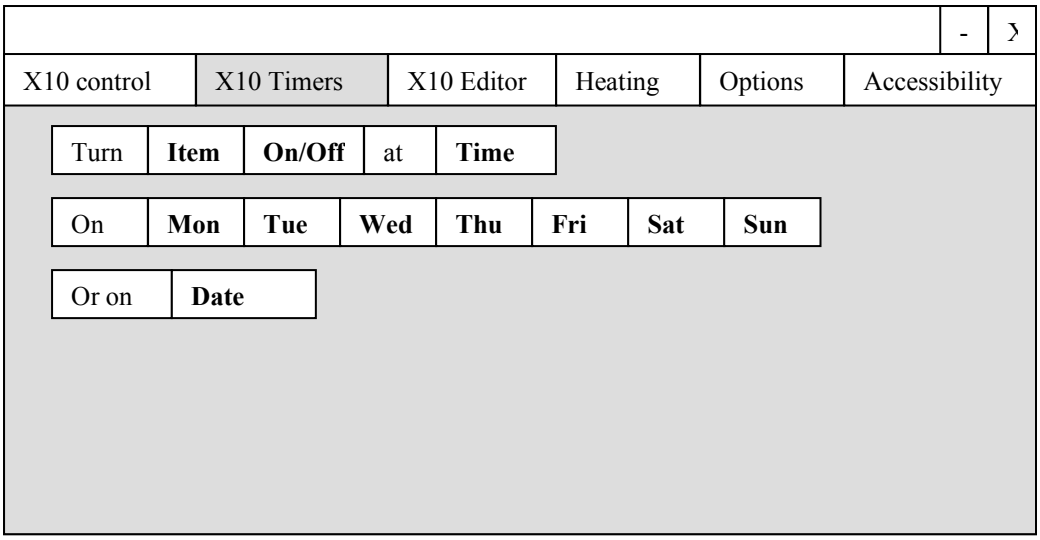
X10 Control

This Dialogue is used to control the X10 items in the house. On the left it lists all the rooms. From this list you select the room you want to work with then on the right hand list all the X10 items in that room are listed. The room is also listed to remind the user what room they are working with. The last thing in the list is the option to turn the item On/Off. This screen uses on average 2 clicks to change an item. 1 to select the required room (if the room is not already selected) 1 click to change the setting for the item and possibly a third click to move down the list if the list is long and the item is at the bottom.



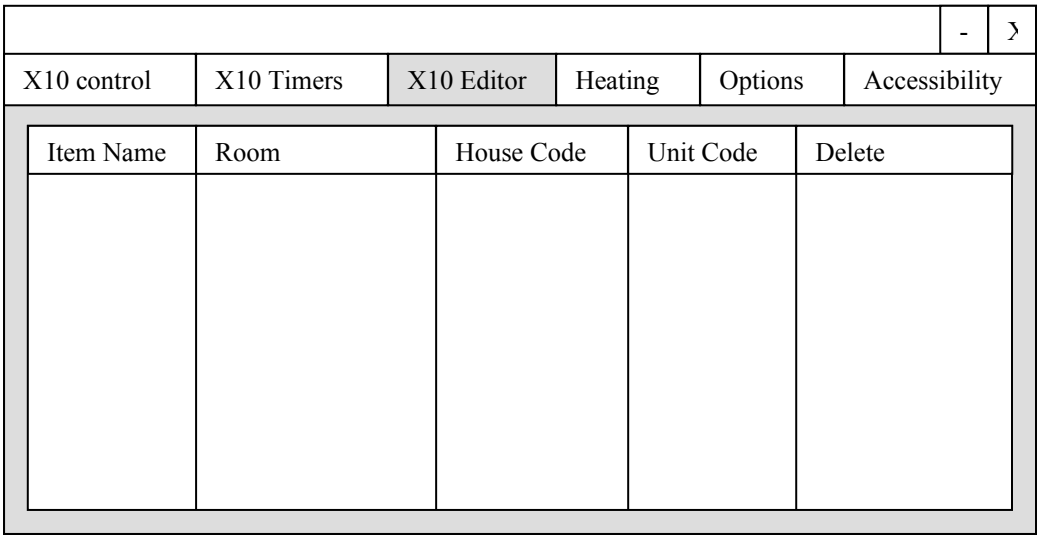
X10 Timers

This screen works on the idea that people will think the want to turn the “front room light” “on” at “11:00pm” on “Saturday” so I have made the options follow this thought process. There is also the functionality to specify a specific date rather than a day.

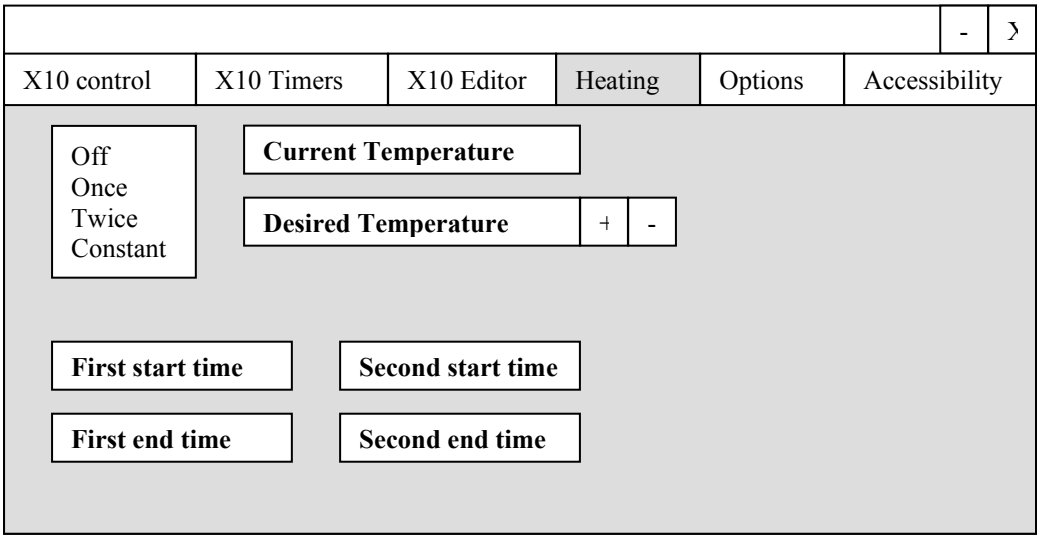


X10 Editor

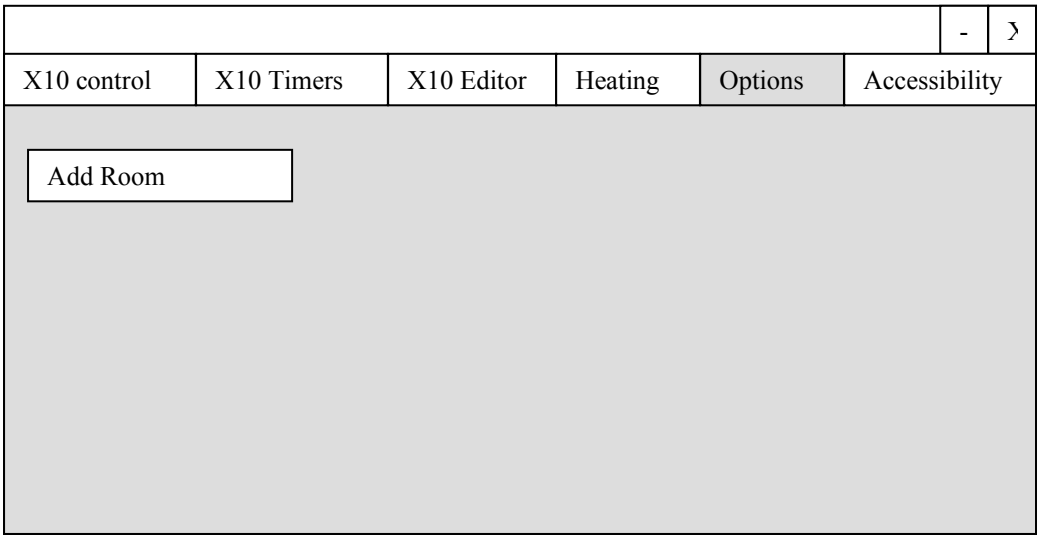
This screen allows a user to edit the X10 items in the house that a re controlled by the System. It allows for the creation of new items and editing of existing items. The item name is a text field room is a drop down box the house and unit codes are drop down boxes as the numbers are limited to 16 for each.



Heating
The mode is selected with option boxes with the other fields being text boxes.

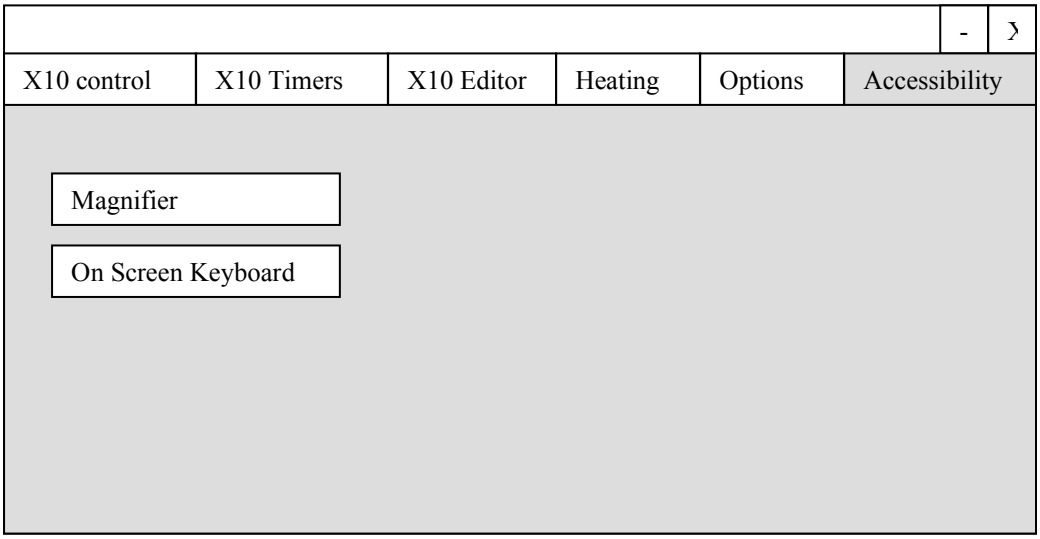


Options
This is not primarily part of the User Interface Design. It is included in the designs to show where in the system it fits in.



Accessibility controls

This is another area that has not been fully designed. It is purely to show functionality and features.



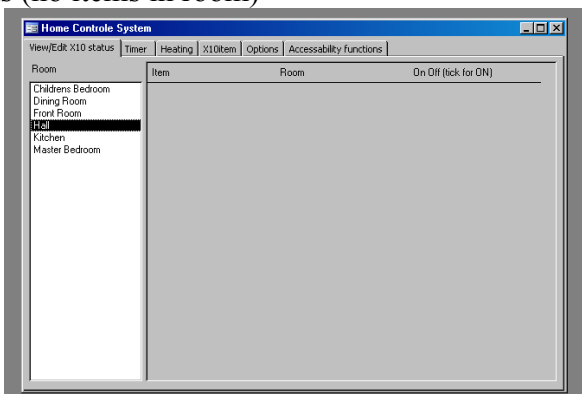
1.3.Design & Specification

1.3.1.Screen Shots

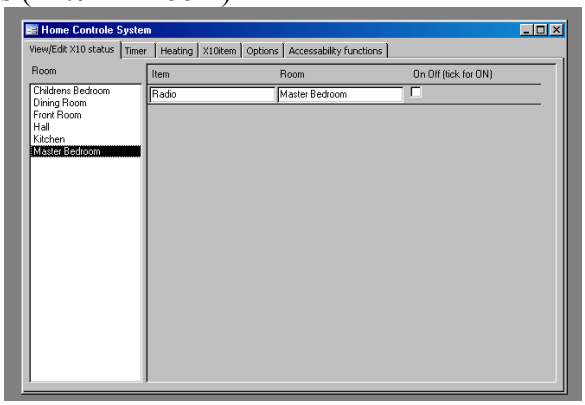
View/Edit X10 Items

This is the First and most commonly used screen. This allows you to select a room in the left hand list, once you have selected a room the controllable systems in that room are listed on the right.

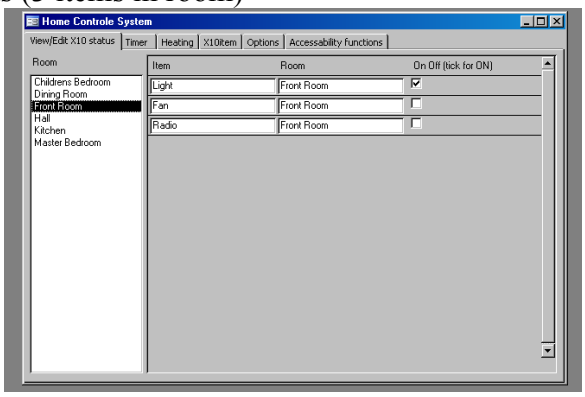
View/Edit X10 Items (no items in room)



View/Edit X10 Items (1 item in room)

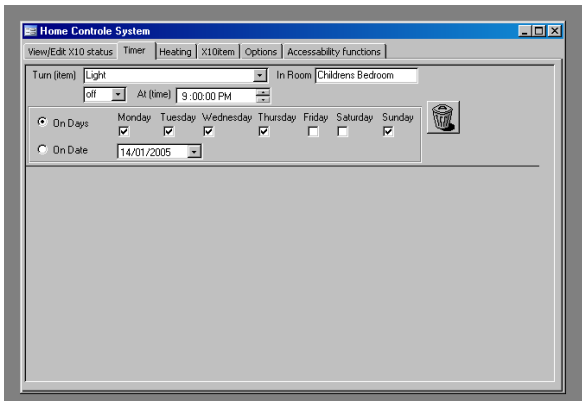


View/Edit X10 Items (3 items in room)

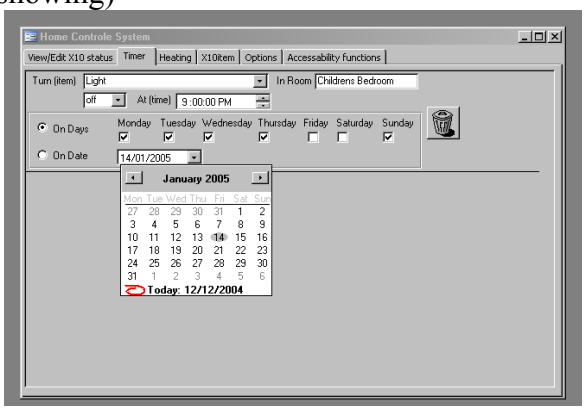


Timer

This allows users to specify timer objects in their system so that they can turn a light (for example) on (or off) at a specified time on a specified date or on specified days (recurring).

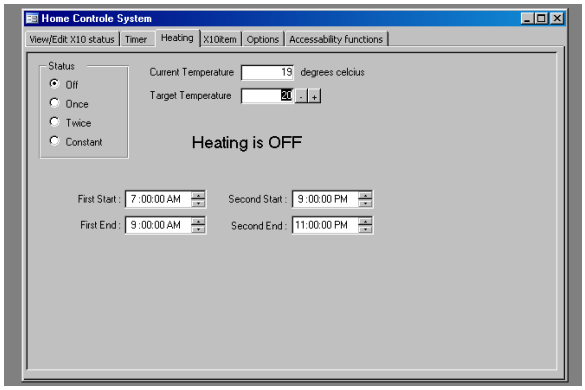


Timer (date control showing)

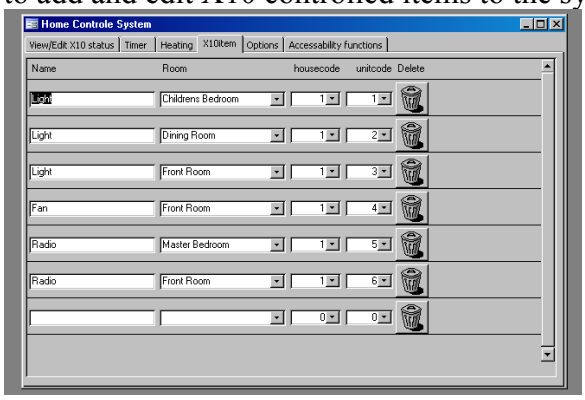


Heating

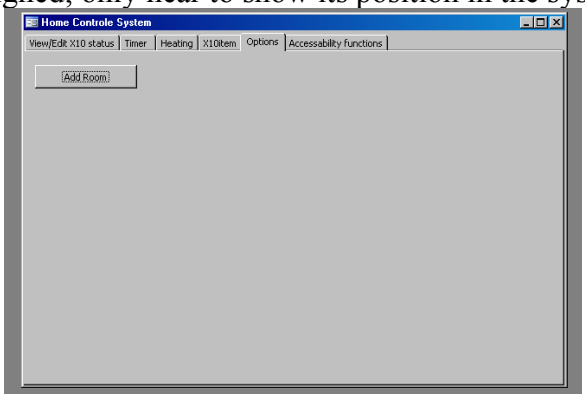
This screen allows people to control when the heating is on and to set the target temperature.



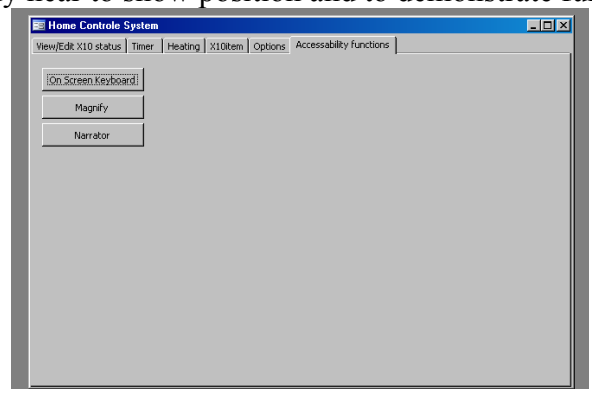
X10Item (create and edit X10 items)
This allows the user to add and edit X10 controlled items to the system.



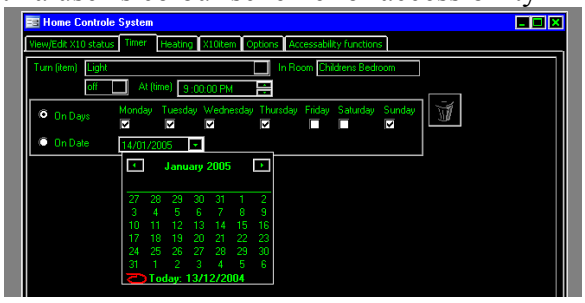
Options
This is not fully designed; only hear to show its position in the system.



Accessibility Functions
Like the options only hear to show position and to demonstrate functionality.



Timer Screen
This screen shot is using a different set colour scheme from windows showing how the system works with a user's colour scheme for accessibility



1.3.2. Detailed Task Analysis

0. *To turn item on/off.*
    0.1. Load application.
        0.1.1. Find Application Icon.
        0.1.2. Double Click on application Icon.
    0.2. Select Item.
        0.2.1. Select "X10 Control" screen.
            0.2.1.1. Find "X10 Control" tab at top of screen.
            0.2.1.2. Click "X10 Control" Tab.
        0.2.2. Select required room that the item is in.
            0.2.2.1. Look up and down the list on the left for the name of the required room.
            0.2.2.2. Click on the room name.
        0.2.3. Find item in list.
            0.2.3.1. Look up and down list on the right hand side of items in the selected room.
    0.3. Change status.
        0.3.1. Click on the tick box by the item name to change status.

0. To set a timer.
    0.1. Load application.
        0.1.1. Find Application Icon.
        0.1.2. Double Click on application Icon.
    0.2. Go to timer screen.
        0.2.1. Find "Timer" from the tabs at the top of screen.
        0.2.2. Click "Timer" tab.
    0.3. Set timer for item.
        0.3.1. Move to bottom of timer list.
            0.3.1.1. Click down arrow till bottom item appears.
        0.3.2. Select desired item from drop down list.
        0.3.3. Select status to change the item to (On/Off).
        0.3.4. Select time to perform action.
            0.3.4.1. Click on the hour number then click on the up/down arrows respectively to change the value.
            0.3.4.2. Click on the Minuet number then click on the up/down arrows respectively to change the value.
            0.3.4.3. Click on the AM/PM then click on the up/down arrows to change the value.
        0.3.5. Select "On Days" or "On Date".
            0.3.5.1. Click on the required title or option box (respectively).
        0.3.6. Select when you want the action to occur.
            0.3.6.1. Click the down arrow on the date box to bring up a calendar.
            0.1. Select the required date.
            0.3.6.2. Click on the arrows at the top to select month & year.
            0.3.6.3. Click on the number of the day required.
            0.3.6.4. Select the tick boxes for the required days you want the timer to repeat on

0. Adjust Heating

1. Load application.
    1.1.1. Find Application Icon.
    1.1.2. Double Click on application Icon.
2. Go to timer screen.
    2.1.1. Find “Heating” from the tabs at the top of screen.
    2.1.2. Click “Heating” tab.
3. Select required status (Off, Once, Twice, Constant).
    3.1.1. Click on the required title or option box (respectively).
4. Select required temperature.
    4.1.1. Click on the “+” and “-” buttons by the desired temperature box (respectively).
5. Select the required start and finish times.
    5.1.1. Click on the hour number then click on the up/down arrows respectively to change the value.
    5.1.2. Click on the Minuet number then click on the up/down arrows respectively to change the value.
    5.1.3. Click on the AM/PM then click on the up/down arrows to change the value.

0. Edit X10 Item

0.1. Load application.
    0.1.1. Find Application Icon.
    0.1.2. Double Click on application Icon.
0.2. Go to timer screen.
    0.2.1. Find “X10 item” from the tabs at the top of screen.
    0.2.2. Click “X10 item” tab.
0.3. Find item in list.
    0.3.1. Click down arrow till required item appears.
0.4. Edit the name.
    0.4.1. Type in the name field of the item its new name.
0.5. Change the room.
    0.5.1. Click on the down arrow on the room box.
    0.5.2. Click on the room name required.
0.6. Select the house code.
    0.6.1. Click on the down arrow of the house code box and select the required number.
0.7. Select the unit code.
    0.7.1. Click on the down arrow of the unit code box and select the required number.

Deleting an item. To delete a timer or X10 item select find the item in its respective list and click the delete button (shown below)

1.3.3. Error Messages

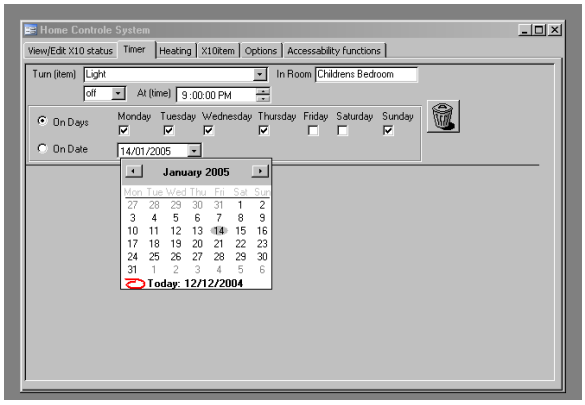
All error messages in the application aim to use windows standard message boxes with clear text. All the functions in the system for changing factors will only accept values from the relevant dropdown boxes except for the text which can’t be verified.

So the only error messages are system errors. None have been implemented into the prototype.

2. Evaluation

2.1.Full Description

2.1.1.Screenshot of final solution



2.1.2.Summery of evaluation Techniques

There were several different parts to the evaluation covering a number of different evaluation methods.

DECIDE Preece et al (2002)

Determine the over all *goals* that the evaluation addresses.
Explore the specific *questions* to be answered.
Choose the *evaluation paradigm* and *techniques* to answer the questions.
Identify the *practical issues* that must be addressed, such as selecting participants.
Decide how to deal with the *ethical issues*.
Evaluate, interpret and present the *data*.

Cognitive walk through

This is the idea of before an actual user looks at the system the designer pre-empts what the user will do and how a user will work their way through a system. As the system in question is only a prototype of the interface rather than a fully working system this is a good place to start.

Nielsen's Heuristics Nielson (2004)

A list of design aims laid out by the usability guru Jacob Nielson. These cover how to make a programme (or website) accessible and easy to use.
This is commonly carried out by 5 experts so that they will manage to catch (in theory) 75% of usability problems.

2.1.3.Running the evaluation tests

DECIDE

Goals – The goals of the evaluation are:

- The system is easy to move around
- The feedback is clear
- Changing settings is simple and options are not ambiguous

Questions – The questions needed to be answered are:

- Are you able to get from one screen to the desired screen easily (including find the desired screen)?
- Are you able to find the settings you wish to change?
- Does the system inform you clearly what the status is of each item?
- Are you able to change the required items without prompting?

Evaluation Paradigm – The evaluation paradigms to be used are:

- Cognitive Walk through
- Nielsen's Heuristics

Practical Issues – The practical issues for this evaluation are:

- Selecting experts for the heuristics testing
- Setting up the software for testing

Ethical issues – The ethical issues for this evaluation are:

- Rights of the Tester to anonymity
- Permission from tester

Cognitive walk through

I worked through the system looking at each aspect of the user interface (screen shots of this in section 1.3.1) and also worked my way through the Task Analysis (section 1.3.2).

Nielsen's Heuristics Nielsen (2004)

5 members of my course were introduced to the prototype and were given a sheet with Nielsen's heuristics written on it as titles and they had to comment on the application and how it met each of the criteria. Some of the items have been removed as they are not relevant to the prototype. Question sheet included in appendix 1

2.2.Summary of Results of Evaluation

2.2.1.Cognitive walk through

The Cognitive walkthrough yielded few errors as this process was used subconsciously through out the design process. However it gave me the opinion that the user interface was Simple, Consistent and easy to navigate.

2.2.2.Heuristic Evaluation

The heuristic evaluation gave me far more information about my system and the way users look at it. Primarily as I was getting ideas from people who were not already familiar with my system. The key comments/running trends are listed below:

Visibility of system status

- Once items were found their status was clear
- The heating status is clear if poorly presented

Match between system and the real world

- X10 language and control was clear (when terminology was understood)
- X10 terminology was confusing for people unfamiliar with it
- Other wording should be used instead of "X10 item"

User control and freedom

- All the desired features were within the system
- System is clear
- Few cases where an "Emergency Exit" is required
- "Delete" function serves for "Emergency Exit"
- No "Undo" option

Consistency and standards

- System follows feel of typical MS™ standards
- Consistent style through out the system
- The use of Tabs between screens isn't so common except in option boxes. Some users may not be so used to them
- A list down the left hand side may easier to use for some users

Error prevention

- In most cases it is hard to input an error due to the extensive use of dropdown boxes and other such input devices
- Not all error prevention implemented in prototype

Recognition rather than recall

- The system follows MS™ systems so it is easy to follow
- You very quickly (within minuets) get a feel for the system and how it works

Aesthetic and minimalist design

- The design is clear and simple
- Almost too simple in missing aesthetic aspects that some users may like
- Too few images used to prompt users (some users like pictures)

2.3.Review of Evaluation Processes and Results

2.3.1.Evaluation of Cognitive walk through

The cognitive walkthrough was of little use. It was better than no evaluation however it missed the few faults in the system which were found with the heuristic evaluation. It is more suited to being used consistently through the design process at significant stages of each screen.

2.3.2.Evaluation of Heuristic Evaluation

The heuristic evaluation proved very successful. It opened up the project to some new ideas and pointed out several small faults. No large faults were found in the system possibly due to good design.

This evaluation worked out more resource hungry than the cognitive evaluation as I had to find five experts (easy in this case as I live with a number) and I had to organise the prototype on a system (again easy in this instance as I provided the hardware).

2.3.3.Evaluation of results

The results were clear and consistent thought the heuristic evaluation. The most common comments were:

- The system was easy to follow
- The use of MS™ functions was good and consistent
- The system was easy to learn
- The use of "X10" terminology was confusing for someone who does not understand it.
- The use of tabs could be confusing for someone who had not experienced them (only a small number of users)
- An "Undo" feature would be useful (but not totally required)
- A few images for status would help some users understand what was happening easier.

2.3.4.Future Improvements

With the feedback from the heuristic evaluation it is clear to see that there are no major functionality or organisational changes required. The only changes that could be made are:

Different navigation system
The use of tabs was considered to be a possible sauce of confusion to some users who had not encountered them.
Because of this other methods can be looked into such as having an explorer "tree" type list on the left hand side of the screen for switching screens but this may have similar reactions.
Another solution is a "web browser" style navigation with a main menu screen and the use of "back" buttons on each of the screens.

Undo feature
This could be a small modification to allow the user to "undo" and action, especially if they had clicked somewhere "accidentally" and were not entirely sure what they had clicked.

Change of terminology
The system uses X10 terminology for the X10 items. The reason for this is so that the user (who would be in control of purchasing the X10 items) would be aware what functionality was for the X10 items. However some systems would be setup on behalf of a disabled user and so the use of X10 terminology on the day to day use of the system could be confusing so someone to whom the technology is alien.
Instead terms like "Controllable Items" could be used or just "items" if the terminology is found difficult to understand a focus group could be used to find better terminology.

3. References

Preece, Rodgers, Sharp, (2002), *Interaction Design*, John Wiley & sons Inc.

Jacob Nielsen (2004), *Ten Usability Heuristics*,
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