1 Organizational Aspects

Project:	**Building Automation System**
Subproject:	**Groupoffices-Thermal-Light-Security-Control**
Documenttype:	**Problemdescription**
Documentname:	**team2-problemdescription**
Responsible:	**SFB501-D1**
User:	**Team1**
Description:	System for controlling heat supply, ventilation, lighting and shading to guaranty comfort and energy saving, and in addition simple safety and security.

Version#	Date	Creators	Remarks
v1	3.4.95	Zimmermann	
v1.1	18.4.95	Queins	
v2	24.5.95	Queins	
v2.1	11.6.95	Zimmermann	Small changes and additions
v3	18.12.95	Dellen/Schütze	Unterteilung der Anforderungen/ Funktionalität in Bedingung-stypen Anpassung der Sensoren/Aktu-ratoren an Testraum
team1	18.1.95	Dellen	Einschränkung für Team1 -Lüftung -Temperatur -Licht -Safety

2 Problem

1 Three time periods are distinguished: *off-time* = no occupancy expected; *stand-by time* = occupancy expected but room not occupied; *comfort time* = room occupied

2.1 Informal Description (Statement of Ideas and Need)

2 The total *system* is composed of a *standard room within an university building (namely room 32/418 of Univ. of Kaiserslautern)university building section*with *installation* (including *sensors* and *actuators*), *users* (*group members*, *secretaries, service technicians*, *custodian*, *owner*, and other people like visitors, who are not registered in the system), and the *control system*. The control system is composed of hardware and software components. The building is influenced by its *environment*, mainly the *weather*.

3 The classification of users is done in respect to functionalities. It allows for example, that **<- CL 8**
a custodian inhabits a room and acts in his room like a group member. But there is another way to classify the users. It is a kind of a hierarchy, describing which person can override the settings of another person (top-down in the figure).

4 custodian: set default values

5 secretary: set values depending on the expected behavior of the group members

6 group member: can set individual values

7 custodian: can enforce boundary values

8 *University buildings* can be of different type, depending on usage. The building and usage will differ greatly between administration, lecture halls and the different departments. Here we will assume a typical *computer science department building* The controlled standard room standard roomsectionis assumed to be the space occupied by the research group of one professor as a typical subunit of a department occupied by the members of the research group of one professor. This section may change as the subunit grows or shrinks.

9 The section consists of *offices*, *computer labs*, *peripheral rooms*, *workshops*, *storage rooms*, and *public rooms* (*hallways* etc.).

10 The problem is the delivery of a new control system that satisfies user needs of one standard room section. The control system shall be designed such that it can be easily changed and expanded. In the following tables, the general needs of four user groups are listed: Group members (G), secretaries (Se), service technicians (S), custodian (C), and owner (O). At the top of each table, the user group is shortly described.

2.1.1 Group Member Needs

11 Group members are all members of the research group that work in the space of the group for longer periods, as for example:

12 *Professor, scientists, secretaries (as users), technicians, programmers*, and *stu-*

dents.

13 All but the students have permanent offices (alone or shared) assigned to them.

14 The students use any of the computer labs.

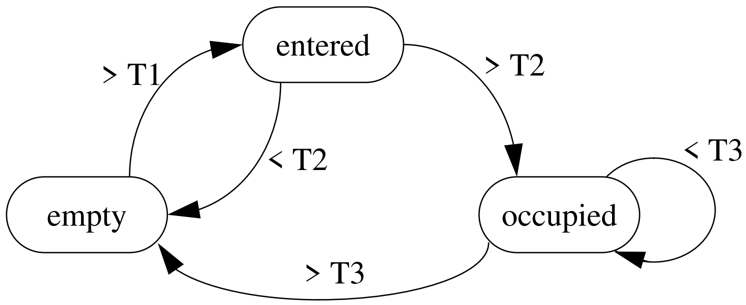
15 Additional rooms have special purposes and are not used for extended periods of work, as for example peripheral rooms, storage rooms, workshops.

16 For simplicity we assume that each *room* has one responsible person that determines the requirements for this room. The *actual user* does not have to be identical to the responsible person. The actual user is one (or more) person, who actually occupies the room. **<- CL 3**

Table 1: Group member needs

#	Short Name	Description	
G1	comfort temperature	The comfort temperature shall be maintained during preset comfort times or reached as fast as possible, when the room is occupied for a longer time period. This state is called “occupied” and is explained in the state chart below. This requirement shall be fulfilled during the heating period, and, if possible, also during the rest of the year. During the states “empty” and “entered” appropriate actions have to be taken.	**<- CL 7**
G2	room ventilation	*Ventilation* in the room has to be in accordance DIN 1946 T.2, according to usage (duration and number of persons in the room). The actual user can override the automatic ventilation in accordance to the above overriding hierarchy.	
G3	lighting	When a person is in the room, lighting conditions including daylight have to be sufficient to move in the room. A minimum of 50 lux has to be maintained on the floor. Working conditions can be established manually. No direct sunlight should reach a workspot.	
G4	security alarm	An alarm has to be triggered when a room is opened or entered without authorization (see below). Local and custodian alarms are distinguished, depending on severity of security violation The severity can be assigned by the custodian.	**<- CL 2**
G5	safety against weather	In the case of hazardous conditions the windows have to be closed to secure the member’s and group’s possessions. Solar radiation has to be limited to prevent paper and equipment damage.	
G6	control comfort	All functions shall be controllable by simple keys (e.g. lightswitch) or a control panel near the main door and by the user’s terminals	
G7	input consistency	The user inputs shall be checked in order to prevent unreasonable behavior of the system. Reasonable values are suggested as soon as the user intent is clear.	
G9	humidity	Humidity shall be controlled within a given range by using outdoor humidity and temperature and ventilation.	
G10	plant life	Natural light shall be controlled such that plants can grow, based on user input. Temperatures below freezing have to be prevented.	

17 We distinguish three time spans for detecting occupancy. If a person is in a room shorter than T1 minutes, the control system does not try to reach the comfort temperature (state “empty”, stand-by or off-time temperature, depending on the time period). If the person occupies the room for a time longer than T1, the system goes into the state “entered” and starts to reach the comfort temperature. If the person leaves the room before T2 minutes, the system returns to the previous temperature. If the person occupies the room longer than T2, the system enters the state “occupied”, where the comfort temperature should be held, until this person leaves the room for at least T3 minutes. Different settings for (T1, T2, T3) may exist for each room, depending on the expected usage (day, night, vacation etc.). **<- CL 7**



Default Values
(set by the custodians)

T1: 1 min.
T2: 5 min.
T3: 30 min.

18 **Custodian Needs**The alarm system detects unauthorized use of all rooms. This can be done by using the given sensors like a motion detector, door lock sensor or others. The alarm system can be turned on and off for every room seperately or for all rooms together. The user interface is the control panel and can be also accessed at the terminals. **<- CL 10**

2.1.2 Secretary Needs **<- CL 6**

19 One or more secretaries are responsible for the administration of one research group.

20

Table 2: Secretary needs

#	Short Name	Description
Se1	holidays	The holidays, vacations of users etc.will be registered in a schedule

21

2.1.3 Custodian Needs

22 One or more custodians are responsible to run the university buildings on a daily bases. They are responsible to adjust the settings for the public rooms like stairways, etc.. They are paid by the owner to fulfill his requirements as good as possible. **<- CL 5**

2.1.4

Table 3: Custodian needs

#	Short Name	Description
C1	room temperature	Custodians set basic minimum and maximum values during normal office times for all room types of a group. They can let the settings be overridden by group members, but also have authority to override group member settings.
C2	room ventilation	Custodians provide a minimum ventilation for the maintenance of the building, esp. to prevent damage by humidity, and for the public rooms.
C3	lighting	Custodians control the lighting of public rooms for safety. They can turn off any light in a room that is not occupied.
C4	security alarm	Specified alarms go to the custodians. The custodians are supported by the system in checking the reason before they go to the location or take other action.
C5	safety against weather	Custodians can force all automatic windows to be closed and all blinds to be up. For manually operated windows the person nearest to the window is signalled. If the window is not closed after 5 minutes, the custodian should be warned. Automatic function as far as possible.
C6	control comfort	The control system provides basic energy saving procedures automatically. If custodian deviates from such settings, the system provides a report on expected results.
C7	input consistency	The system warns against unreasonable inputs.
C8	cost reporting	The system provides reports on current and past energy consumption.
C9	aux. reports	All malfunctions, alarms and unusual conditions are stored and reported on request. Malfunction of components that the system cannot detect, can be entered manually.
C10	Freezing prevention	Freezing of water pipes and radiators has to be prevented by all means.

2.1.5 Owner Needs

23 The owner is in the case of a university the department that is responsible to pay for energy consumption, repairs, maintenance etc.

Table 4: Owner needs

#	Short Name	Description
O1	heating	Minimum heating energy consumption.

Table 4: Owner needs

#	Short Name	Description
O2	ventilation	Sufficient ventilation to prevent damage through humidity.
O3	lighting	Minimum electrical energy consumption and bulb replacement cost.
O4	security	sufficient security against university property loss or damage.
O5	safety	Avoidance of damage to the building, windows, and blind in regard to weather conditions.
O6	reporting	Owner gets monthly reports.
O7	salaries	The number of custodians has to be minimal.
O8	maintenance	Repair and regular maintenance has to be minimal.
O9	off-time	Minimum energy consumption during off-time.

2.1.6 Service Technician Needs

24 If the system does not work correctly, the service technicians are called by the custodians. The technicians attend the hard- and software components of the system. **<- CL 1**

Table 5: Service technician needs

#	Short Name	Description
S1	room temperature	Can override all settings for test. Gets report on any failure or unusual temperature.
S2	room ventilation	Can override all settings for test.
S3	lighting	Can override all settings for test. Gets report on any failure.
S4	security alarm	Can cause test alarms.
S5	safety	Can override all settings for test.
S6	control comfort	Can access and set all data from any terminal on the university network or via an external communication line.
S7	recording	Can record and play-back any test sequences.
S8	maintenance support	Create a list of needed maintenances.

25

2.2 Existing System

26 Currently the *room temperature* is maintained during the heating period with a hot water system and *radiators* with thermostat control valves in each room. Thermostats are operated by group members. Central control is maintained by adjusting the input water temperature.

27 All lights are controlled manually. A security guard turns off lights in empty rooms on his walkthroughs at night.

28 *Blinds* and *windows* can only be operated manually.

29 Safety and security is only supported at night by security guard.

30 **Disadvantages** of the current system:

31 Energy waste by heating of unused rooms, imprecise control through thermostats, hot water generation and distribution loss higher than necessary due to worst case input temperature.

32 Electrical energy is wasted by lighting rooms during empty times and by little possibilities to adjust light sources relative to need and daylight.

33 Blinds, windows, inventory and the building can be damaged by weather due to lack of problem reporting and automatic problem solution if possible.

34 Ventilation cannot be controlled properly and cannot be used to save energy by minimal ventilation periods during heating or to cool rooms during the night to reduce overheating during summer.

35 Blinds cannot be used to reduce solar radiation load during summer to prevent overheating before a room is occupied.

36 Security can be greatly improved by an alarm system.

37 Maintenance bookkeeping is time consuming for custodians and service technicians.

2.3 Proposed System Functionality

38 Need# lists one or more requirements from chapter 2.1 that can be solved by the proposed function.

Table 6: Functions

F #	Need#	Short Desc.	Description
F1	G1, C1, O1	room comfort control	Control the measured room temperature such that the comfort temperature is maintained within given deviations during the comfort time or occupied state and heating period. Set radiator control valves and blinds accordingly. Outside of the heating periods comfort temperature is maintained as good as possible by using the heat storage capacity of the building.
F2	C1-3, C10, O1,3, O9	room stand-by control	Control room temperature during stand-by-time such that a user required heat-up can be guaranteed under normal conditions and energy loss is minimized. The temperature has to be greater than 0^{o}Take temperatures and needs of adjacent rooms into account. C
F3	G1, O1	room heat-up control	Determine heat-up time and start heating up a room such that comfort temperature is reached at begin of comfort times in a moderate time interval and energy consumption is minimized. Take room environment temperatures including heat storage capacity into account.
F4	Se1	stand-by time determination	Determine the period of the current and next stand-by time, taking working habits, holidays, vacation, off-site-times, and presence of a person.
F5	G1	radiation load control	Use solar radiation to heat a room during all times if heating is required or not disallowed, use storage capacity of building. Prevent heating of room by closing blinds if temperatures larger than comfort temperatures can be expected.
F6	G9, O2	humidity control	Use outdoor humidity in respect to outdoor and room temperature to control indoor humidity via ventilation.
F7	G1, O1	temperature control via ventilation	Use outdoor temperatures and heat storage capacity to control room temperature during all times either to save energy or to prevent room temperatures higher than comfort temperature via ventilation.
F8	G2, O2	good air control	Ahead and during comfort times control ventilation to guarantee sufficient fresh air depending on number and time of persons present.

Table 6: Functions

F #	Need#	Short Desc.	Description
F9	G3, O3	minimum lighting control	Use electrical light sources only if room is occupied and to guarantee minimum illumination, use as much daylight as possible by controlling blinds. If user turns on working light, try to reduce power consumption of other light sources.
F10	G3	maximum lighting control	Use blind to prevent extreme radiation values in room. No direct sunlight should reach the workspot.
F11	G3, G6	working lights control	Allow user to control individual light sources as long as room is occupied. Restore setting after return of person within given return period. Warn user, if daylight is sufficient for working.
F12	O3, O8	bulb lifetime control	Do not turn of light for periods where energy saving is smaller than lifetime reduction cost.
F13	G5, C5, O5	blind safety control	Withdraw blind in case of wind exceeding safe values from any direction or in case of extreme solar radiation.
F14	G5, C5, O5	window safety control	Close automatic windows or warn nearest person or custodian in case of possible wind or water damage because of open windows or attempts to open windows.
F15	?	occupancy detection	Try to determine occupancy of room, including number of persons, from infrared detector, door contact history, and keyboard activity.
F16	G4, O4	legal entry determination	Try to distinguish legal from illegal entry into room, using all available data.
F17	G4, C4, O4	security violation handling	In case of illegal entry, try to detect type of security violation and determine appropriate action.
F18	S8	maintenance handling	Provide list of maintenance tasks.
F19	C9	service handling	Keep list of possible sources of installation defects. Propose repairs or other actions.
F20	C9	fault detection	Check all components of installation for possible defects. Report to custodian and service engineer.
F21	G6	user interface	Provide comfortable user interface for different users.
F22	G7, C7	consistency check	Check all input data for consistency.

Table 6: Functions

F #	Need#	Short Desc.	Description
F23	C6	parameter pro-posal	Propose meaningful parameters or defaults to users.
F24	C8-9, O6	reporting	Store selected events in database and provide reports as necessary.
F25	S1	testing	Allow selftest of the system.
F26	O1-3, O9	off-time	Determine the off-time settings in respect of minimum energy consumption.

3 Control System Environment Characteristics

3.1 Problem Context

3.1.1 Fault Tolerance

39 Failures can occur in the installation, in the control system hardware and software, in the use of existing communication channels, and by user errors. In any case the system shall provide a stepwise degradation of functionality down to manual operability.

3.1.2 Error Recovery

40 In the case of a failure and repair of the failure the system is supposed to continue as before the failure as best as possible.

3.1.3 Interference

41 The system is part of a hierarchy of control systems. The next higher system coordinates **<- CL 9** the actual control system (ACS) and other similiar systems (OCS). The ACS do not have the permission to control functions of OCS. It only may pass messages to get informations about sensor values or to make proposals to the OCS.

3.1.4 Safety and Legal Aspects

42 All hardware connections have to be made according to DIN standards.

43 No hazardous conditions for persons, inventory, or building is allowed.

44 Otherwise no legal restrictions apply because the system is part of an experiment.

3.2 System Context

3.2.1 Building Section

45 A section consists of adjacent or separated groups of rooms, accessible via group hallways. Group hallways are connected by public hallways and staircases. Group hallways can be shared by several groups.

46 Group hallways are controlled by locks and *contacts*. The locks can be permanently open, open at times, locked at times, permanently closed and permanently locked from the outside. The locks can always be opened from the inside because of fire exit regulations.

47 Adjacent rooms may have connecting doors.

48 Rooms can be offices, computer labs, peripheral rooms, workshops, and storage rooms.

49 The room is surrounded by two rooms and a hallway, each with doors and has three window sections.

50 All rooms can have at least one door to the group hallway and at least one window.

51 All windows have a lower and an upper *sash*. The lower sash can be tilted or fully opened. The upper sash can only be tilted.

52 All windows except on the north side of a building have blinds.

3.2.2 Installation

53 Each room is equipped with
one or more motion detector, so that the room is fully covered,
three air temperatur sensors in different positions,
a ceiling light detector,
a humidity detector
a room siren.

54 Each window section of a room is equipped with:
one radiator with a radiator control valve,
an input and an output water temperatur sensor
as well as a mean radiator temperature sensor,
an upper sash opener,
a blind opener,a combined blind lifter/rotator
a sash-closed, sash-locked, and a sash-opened contact for the lower sash,
a sash-closed contact for the upper sash,
a ceiling light fixture that can be dimmed.

55 Each door is equipped with
a door-closed, a door-open, and a lock-closed contact.

56 In addition, a desk lamp exists for each group member with an office workspace.

57 Hallways are equipped with
sections of connected light fixtures that are turned on together.
a siren for group alarms.

58 All rooms, except the public rooms, have a control unit to adjust the individual comfort **<- CL 4**
values of the actual user. The values for the public rooms are adjusted by the custodians. The

control unit is composed of the light and blind push buttons and a little control panel one-line display and a keyboard. At the control panel the five last messages of the system (errors, warnings, ...) can be displayed. All the functions of the control unit can be also accessed through an user interface which can be displayed at each terminal.

59 Outside rain, temperature, humidity, *wind speed* and *wind direction*, and *solar radiation* are measured at one place for one or more sections. It is assumed that different parts of a section are not separated more than to make these measurements invalid. So there is only one point to observe the outside environment.

3.2.3 Sensors

60 This section describes the real physical sensors including converters if necessary.

61 Ananlog sensors have typically an exponential time response. Reaction time is the time from a change of the sensed property to the time when the sensor has reached 90% of the change, excluding conversion time. Conversion time is the time to convert the analog to a digital value, that can be accessed by the control system.

62 NC means “normally closed”. Closed is coded as 1, open as 0.

Table 7:

Name	Abbrev.	Type	Resolution	Range	Reaction / Conversion Time	Description
door-closed contact	dcc	NC-contact		0, 1	10 ms	It is placed above the door and is 1, if the door is fully closed.
door-open contact	doc	NC-contact		0, 1	10 ms	It is placed above the door and is 0, if it is opened for at least 30 degree.
door-lock contact	dlc	NC-contact		0, 1	10 ms	It is placed in the door frame and is 1, if the lock is closed with a key
motion detector	imd	passiv infrared motion detector		0, 1	1 s	1 means a person is moving, even very slow, in the range of the detector.
room humdity sensor	rhs	analog, capacitance	1 %	10-90 %	300 s / 1s	measures relative humidity
sash-closed contact	scc	NC-contact		0, 1	10 ms	It is placed above the window sash and is 1, if the window is fully closed.
sash-lock contact	slc	NC-contact		0, 1	10 ms	It is placed in the lock of the sash and is one if the sash is manually locked.

Table 7:

Name	Abbrev.	Type	Resolution	Range	Reaction / Conversion Time	Description
sash-open contact	soc	NC-contact		0, 1	10 ms	It is placed at the side of the window and is 0, if it is opened for at least 30 degree.
water temperature sensor	wts	analog PWM contact thermometer	0.1 C	0 - 100 C	10 s / 1s60s	Connected to the incoming and outgoing water pipes near the radiator.
room temperature sensor	rts	analog PWM air thermometer	0.1 C	-40 - +70 C	60 s / 1s60s	It measures the room temperature at three points of the room.
ceiling light sensor	cls	analog light sensor	1 lux	1 - 1000 lux	10 ms / 1 s	Mounted below the ceiling, measures the illumination of the ceiling as a measure of the average illumination of the room.
wind speed sensor	wss	analog FM anemometer	1 ms^{-1}	0 - 56 ms^{-1}	10 s / 10 s	Mounted on the roof of the building
wind direction sensor	wds	analog	1	0 - 359	10s / 1 s	Mounted on the roof of the building
outdoor temperature sensor	ots	analog PWM air thermometer	0.1 C	-40 - +60 C	120 s / 160 s	Mounted in the shadow of the building
outdoor humidity sensor	ohs	analog PWM	1%	10 - 90%	300 s / 130 s	Mounted in the shadow of the building
outdoor rain sensor	ors	digital, contact surface		0, 1	1 s	1 means it is raining, 0 means sensor is dry. Mounted on the roof of the building
outdoor rain sensor	ors	quasi-analog	1mm	1-100 mm/h	sev. min.	counts the mm of rain since last reset (every 24h).

3.2.4 Actuators

63 Actuators have a linear time response. Reaction time is therefore defined as the time to change from 0 to 100% / 100 to 0%, if different.

64 One can not expect that actuators are completely linear over a longer period of time. Position of actuators must therefore be controlled by using positions known for sure (e.g. ‘completely closed’) as reference.

65 3-point means three control states: forward, stop, backward. The actuator moves as long as the forward or backward state is on. Thus the position can be controlled by the length of time in the two states, depending on the previous position. End-contacts are provided to stop the motion automatically and to signal the control system.

Table 8: Actuators

Name	Abbrev.	Type	Range	Control	Reaction Time	Description
blind-lifter		motor	0 - 100%	3-point	100 s	Lets down blind between 0% (up) and 100% (down).
blind-rotator		motor	0 - 180	3-point	60 s	Rotates blind blades between 0 and 180 degrees. At x degrees light can enter from an angle x degree from vertical. At 0 and 180 the blind is totally closed.
dimmer		dimmer	0 - 100%	analog	10 ms	Controls light between 0 (off) and 100% (on). NOT YET AVAILABLE IN STANDARD ROOM!!!
hall-siren		siren	steady tone and intermittend		1 ms	Sounds group alarm.

Table 8: Actuators

Name	Abbrev.	Type	Range	Control	Reaction Time	Description
blind lifter/ rotator		motor	lift: 0..100 % rotate: 0..180 a	3-point	lift:120 s rotate: 15s	Lets down blind between 0% (up) and 100% (down). Rotates blind blades between 0 and 180 degrees. At x degrees light can enter from an angle x degree from vertical. At 0 and 180 the blind is totally closed. DOWN command sets the angle to 0 degrees and starts moving down the blinds afterwards. UP command sets the angle to 180 and starts moving up afterwards. All settings are reached by useful combinations of up- and down-commands.
radiator-valve		radiator control valve	0 - 100%	3-point	60420 s	Electrically controlled to open continuously between 0 and 100%.
room-siren		siren	room			Sounds alarm in room.
window-opener		motor	0.. 100%	3-point	25 s	Tilts sash between 0 and 100%. MOVEMENT NOT LINEAR.

4 Dictionary of Terms

66 Reference points to entries in the document “Lexikon”

Table 9: Dictionary of keywords of the application domain

keyword	reference	description	german
actual user		current user of a room	aktueller Benutzer
actuator		device that can be controlled by control system	Aktuator
blind	jalousie	used to shade window from the outside	Jalousie
comfort temperature	!	expected temperature during normal usage of a room	
comfort time		time period in which full room climate comfort is expected	Benutzungszeit
computer lab		Room with many terminals, workstations, open to all group members and temporarily to students of a class	Terminalraum
computer science department building		building with typically offices, computer labs, peripheral rooms etc.	Informatikgebäude
contact		electrical or magnetic gadget to determine the state of a door, window etc.	Kontakt
control panel		Small panel at the wall with a keyboard, LEDs for important states, and a simple display for textual messages	
control system		Hard- and software system that controls indoor climate, lighting, safety and security	Kontrollsystem
custodian		Person responsible for running a building on a daily bases	Hausmeister
door	door		Tür
environment		surrounding of section of the building, indoor and outdoor	Umgebung
group member		Persons in research group of one professor	Gruppenmitglieder
hallway	hallway	part of a building between several rooms to connect each of them	Flur
heating period	!	period of the year in which central heat is supplied	Heizperiode

Table 9: Dictionary of keywords of the application domain

keyword	reference	description	german
heat-up time	!	time in which comfort temperature is reached	Aufheizzeit
humidity	air		Luft-feuchtigkeit
installation	installa-tion	Equipment belonging to the building and that can be operated, as e.g. radiators, win-dows openers, light fixtures	Installation
office	office	Room for one or two group members with terminals and/or workstations for inhabitants	Büro
off-time		time in which no usage is expected	
owner		Head of university	Präsident
peripheral room		Room for computer peripherals, copy machines, general group access	Peripherie-raum
professor		head of a research group	Professor
programmers		people who realize implementations	Programmierer
public room		Accessible to all group members and the public at all times	
radiator	radiator	hot water radiator	Heizkörper
radiator con-trol valve	! radia-tor con-trol valve		Heizkörper-ventil
rain sensor		closes contact if wet	Regenfühler
responsible person	!	Person responsible for individual settings of one room	
room	room		Raum
room tempera-ture	room cli-mate	Temperature of the air	Raumtempera-tur
sash	sash	flexible part of a window, door etc.	Flügel
scientists			Wissen-schaftler
secretary			Sekretärin
sensor		device that can sense state of the building, users or environment	Sensor

Table 9: Dictionary of keywords of the application domain

keyword	reference	description	german
service technician		Person responsible for maintenance and repair of controlled system	Servicetechniker
solar radiation	solar radiation	Irradiance, measured in w/m^2	Sonneneinstrahlung
stand-by time		time in which an inhabitant is expected in a room	
storage room	storage room	Room for storage of files, books, manuals etc., access for all group members	Lagerraum
students			Studenten
system			System
technician			Techniker
university building		Building in a university	Universitätsgebäude
user			Benutzer
ventilation	!	According to DIN 1946T.2 is the minimal fresh air input per person in an office or lecture hall 30 m^3h^{-1}	Belüftung
weather		outdoor temperature, wind, radiation, humidity	Wetter
wind direction	wind	Direction from which the wind is blowing. North is 0 , east is 90 .	Windrichtung
window	window		Fenster
wind speed	wind		Windgeschwindigkeit
workshop	workshop	Room with tools and special machines for electronic and metal work, access for technicians	Werkstatt

5 Change Log

Problem # 1, Detection Date & Version: 23.5.95, v1.1

Reason:

Description:

No description about the service technicians.

Solution:

Give a short description.

Change Date & New Version: 24.5.95, v2

Problem # 2, Detection Date & Version: 23.5.95, v1.1

Reason:

Description:

No assumption about en- or disabling the telephone use in case of an alarm.

Solution:

Delete this sentence.

Change Date & New Version: 24. 5. 95, v2

Problem # 3, Detection Date & Version: 23.5.95, v1.1

Reason:

Description:

Inhomogenous conception of “actual user”.

Solution:

Short definition of the meaning.

Change Date & New Version: 24.5.95, v2

Problem # 4, Detection Date & Version: 23.5.95

Reason:

Description:

No assumption about the control of the system

Solution:

Give an overview of the several kinds of control units.

Change Date & New Version: 24.5.95, v2

Problem # 5, Detection Date & Version: 23.5.95, v1.1

Reason:

Description:

Who is responsible for the public rooms like stairways, ...

Solution:

The custodian has to fulfill these tasks.

Change Date & New Version: 24.5.95, v2

Problem # 6, Detection Date & Version: 23.5.95, v1.1

Reason:

Description:

The needs of the secretaries should be listed in a separate manner. This is necessary because of the special interface, the secretaries need to fullfil this task.

Solution:

Create a new table secretary needs.

Change Date & New Version: 29.5.95, v2

Problem # 7, Detection Date & Version: 23.5.95, v1.2

Reason:

Description:

Inhomogenous conception of the time when the comfort temperature should be reached or the stand-by temperature is sufficient.

Solution:

Give an explanation by a state chart.

Change Date & New Version: 30.5.95, v2

Problem # 8, Detection Date & Version: 23.5.95

Reason:

Description:

There is no description who may override the settings of another.

Solution:

Build a hierarchy to explain it.

Change Date & New Version: 30.5.95, v2

Problem # 9, Detection Date & Version: 23.5.95

Reason:

Description:

No assumption about the interference with other control systems.

Solution:

Arrange the system in a hierarchy of control systems.

Change Date & New Version: 31.5.95, v2

Problem # 10, Detection Date & Version: 23.5.95, v1.1

Reason:

Description:

Discussion of the security alarm system.

Solution:

Give a more precise description of the desired functionality.

Change Date & New Version: 1.6.95, v2