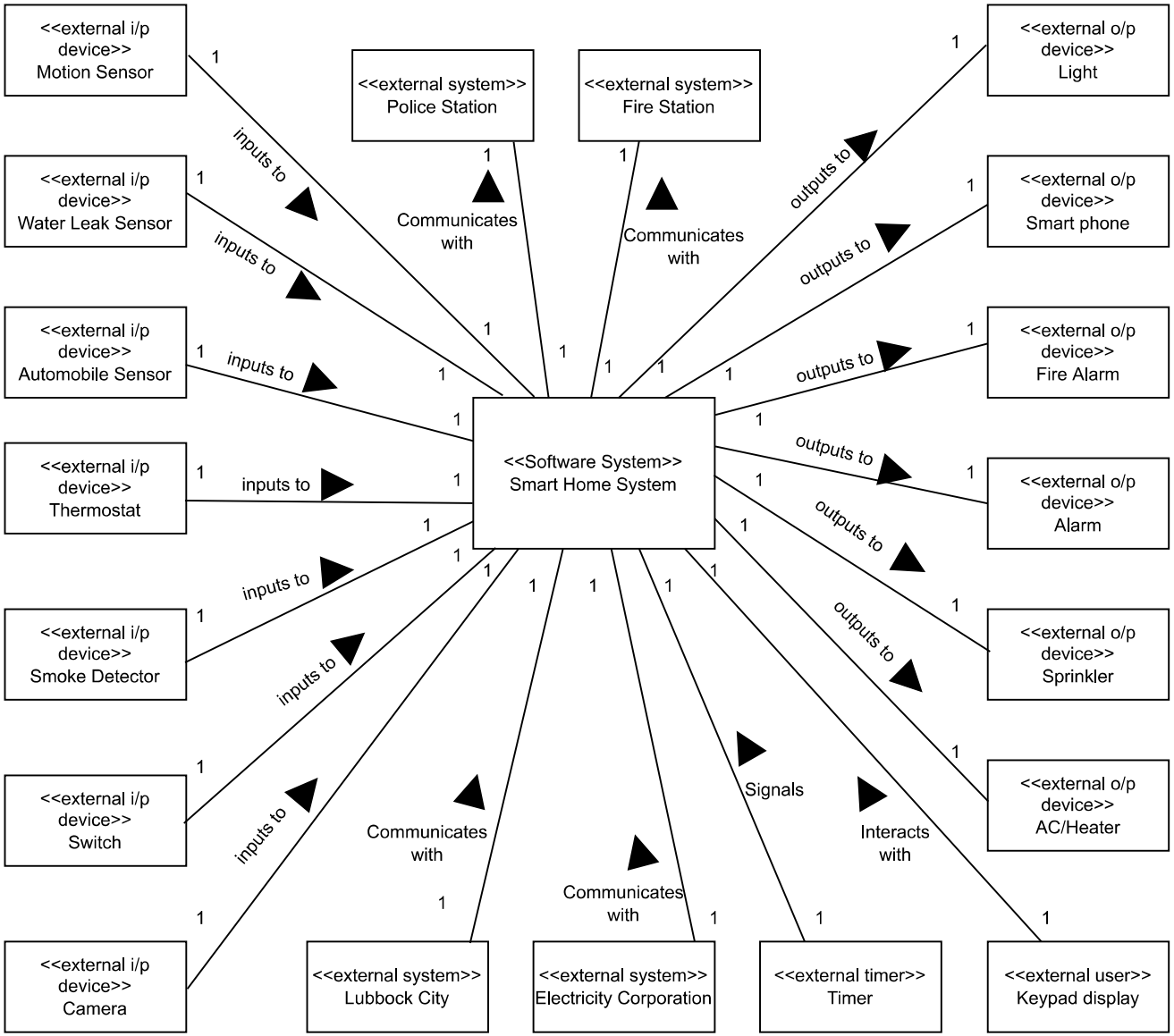
PHASE - 1

A) CONTEXT MODEL


<<external i/p device>> Motion Sensor
<<external i/p device>> Water Leak Sensor
<<external i/p device>> Automobile Sensor
<<external i/p device>> Thermostat
<<external i/p device>> Smoke Detector
<<external i/p device>> Switch
<<external i/p device>> Camera
<<external system>> Police Station
<<external system>> Fire Station
<<Software System>> Smart Home System
<<external o/p device>> Light
<<external o/p device>> Smart phone
<<external o/p device>> Fire Alarm
<<external o/p device>> Alarm
<<external o/p device>> Sprinkler
<<external o/p device>> AC/Heater
<<external system>> Lubbock City
<<external system>> Electricity Corporation
<<external timer>> Timer
<<external user>> Keypad display
inputs to
Communicates with
outputs to
Signals
Interacts with
1

B) STATIC MODEL

Fig - Static model of entity classes

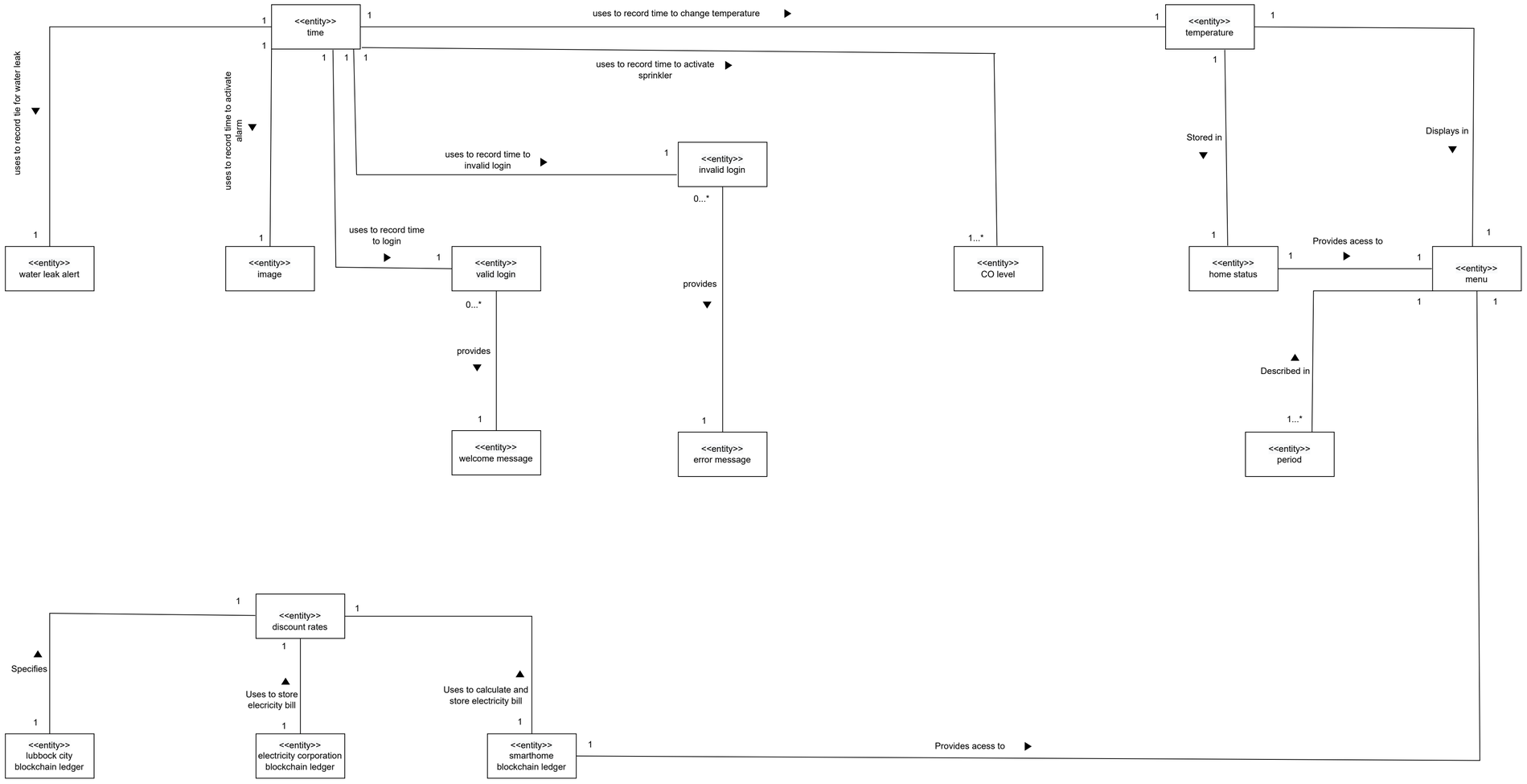


Fig - entity classes and their attributes

C) SEQUENCE DIAGRAMS

Control temperature use case:

Object structuring criteria:

1)Thermostat interface - <<i/p device interface>>(boundary)

2)Smart Home system control - <<state dependent control>>

3)Temperature comparison service - <<service>>

4)AC/heater interface - <<o/p device interface>>(boundary)

5)AC/heater - <<external o/p device>>

6)Time - <<entity>>

7)Temperature - <<entity>>

Fig - sequence diagram for control temperature usecase

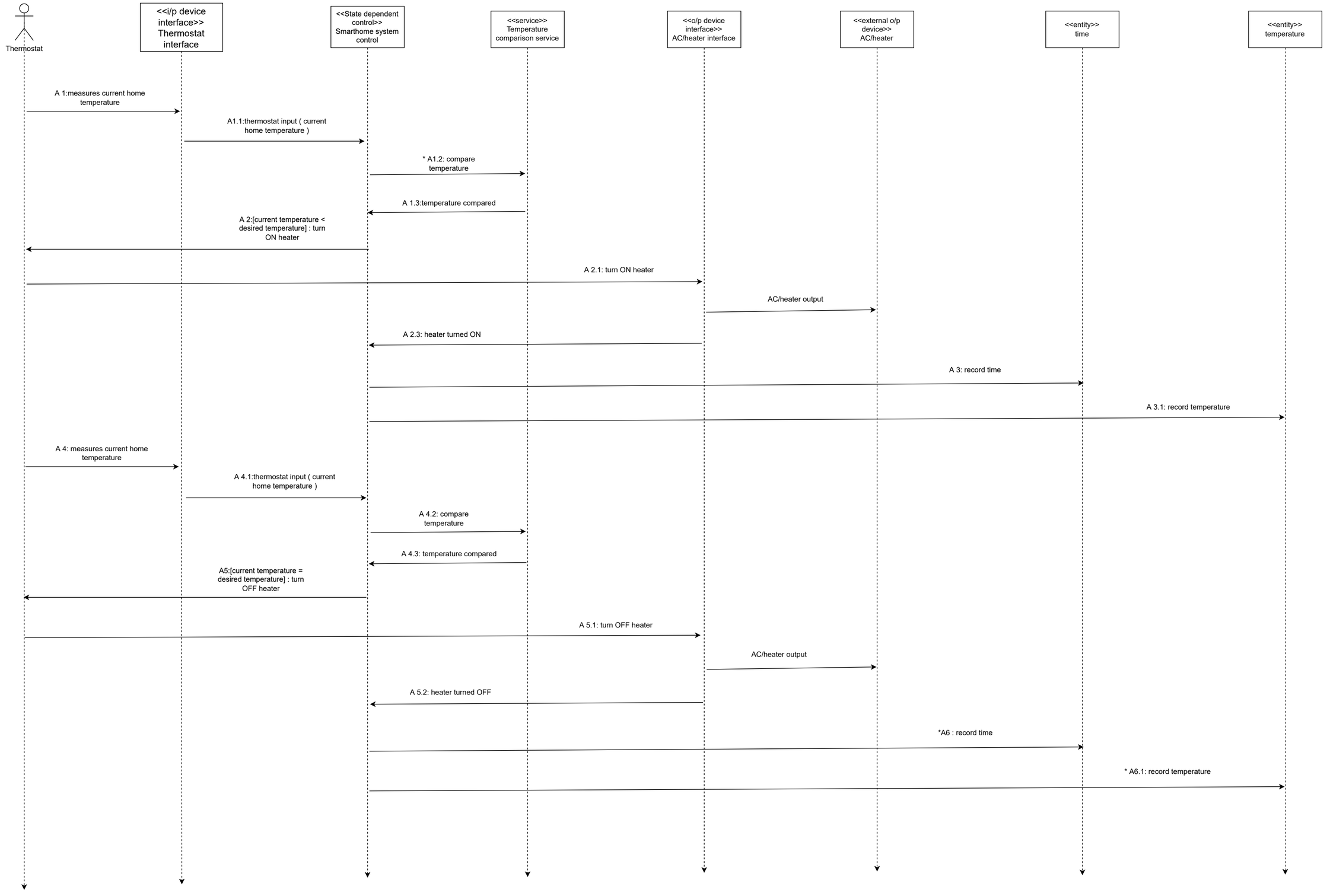
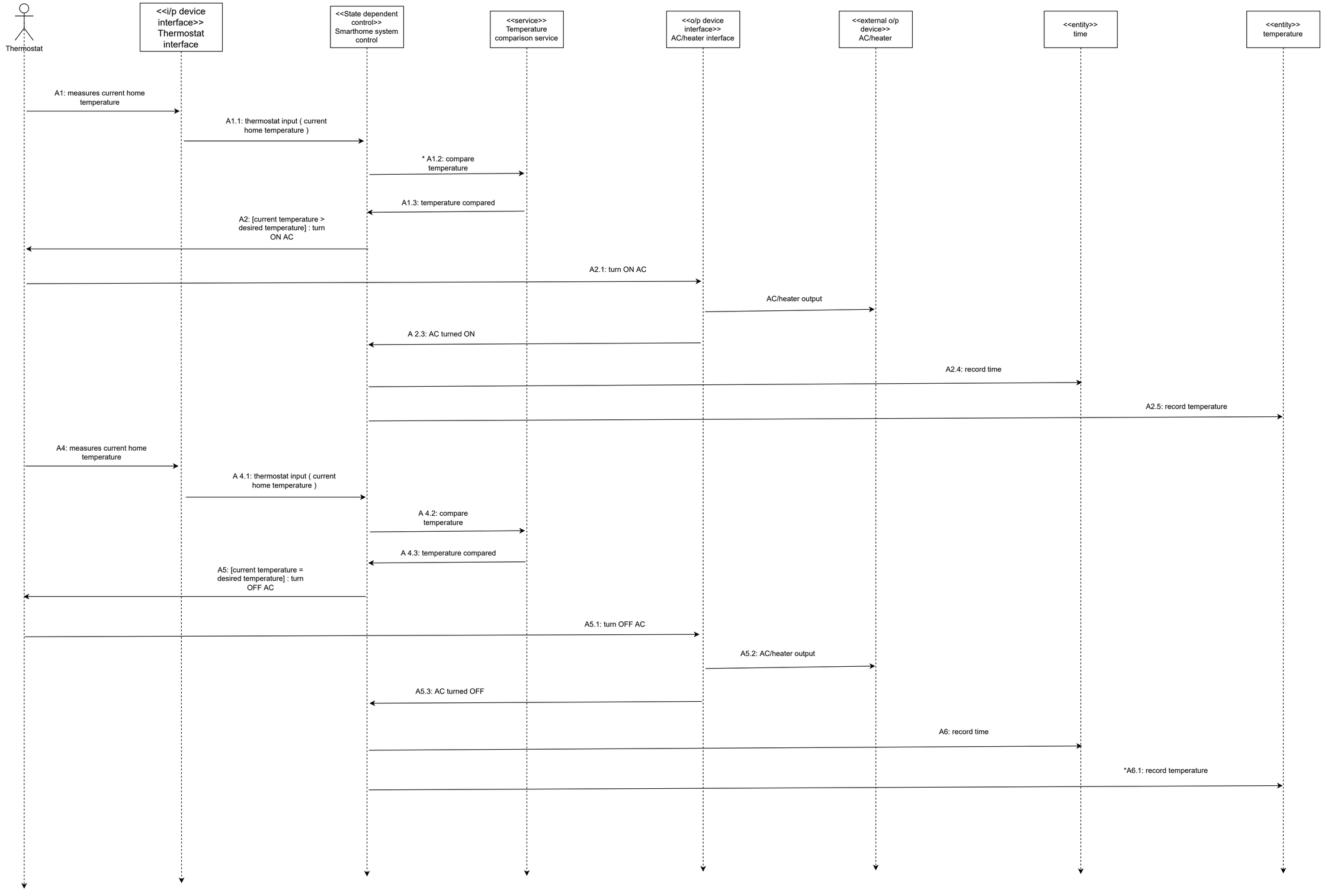


Fig - sequence diagram for control temperature usecase (alternative)



Set desired temperature use case:

Object structuring criteria:

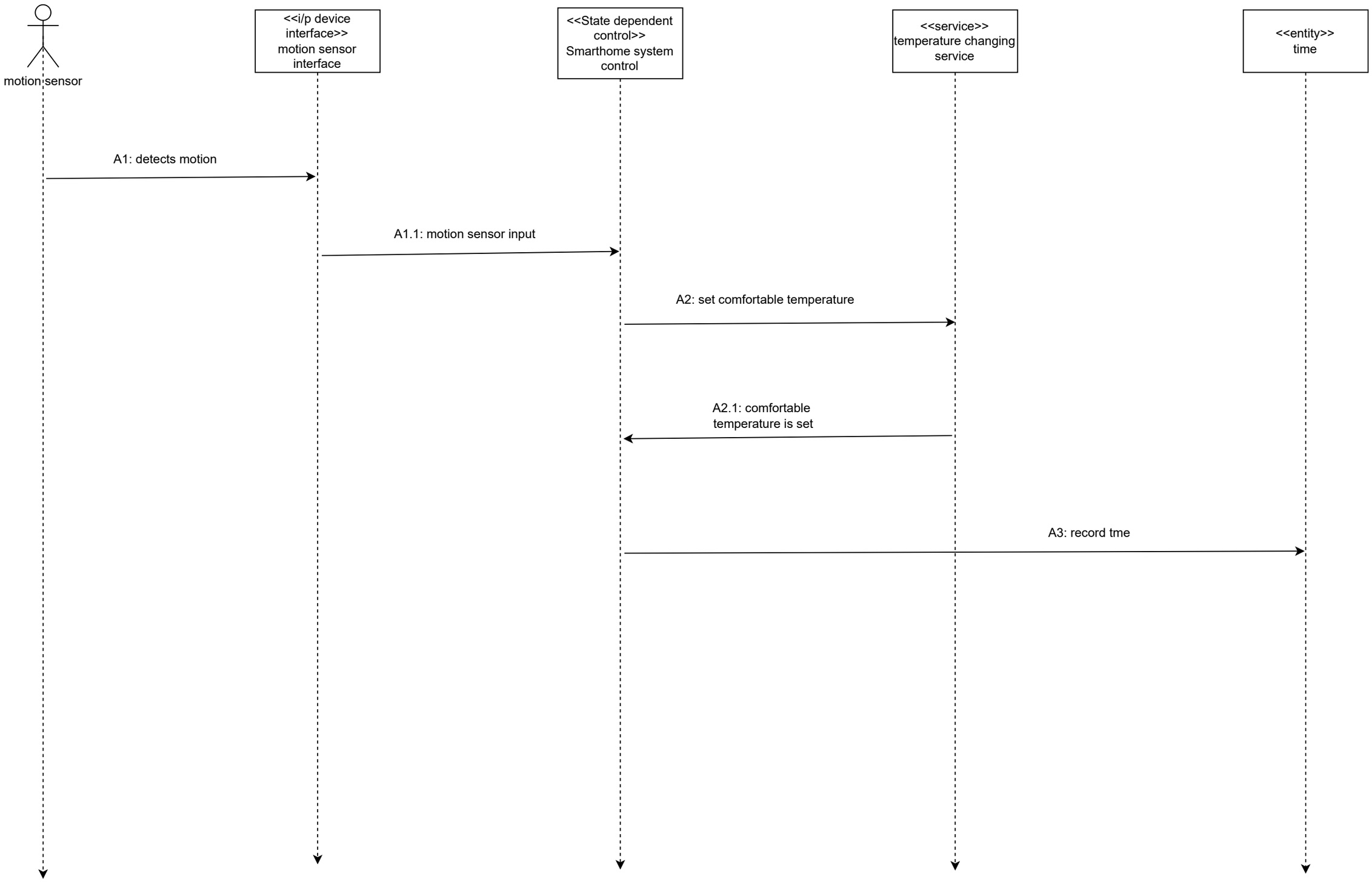
1)Smart Home system control - <<state dependent control>>

2)Motion sensor interface - <<i/p device interface>>(boundary)

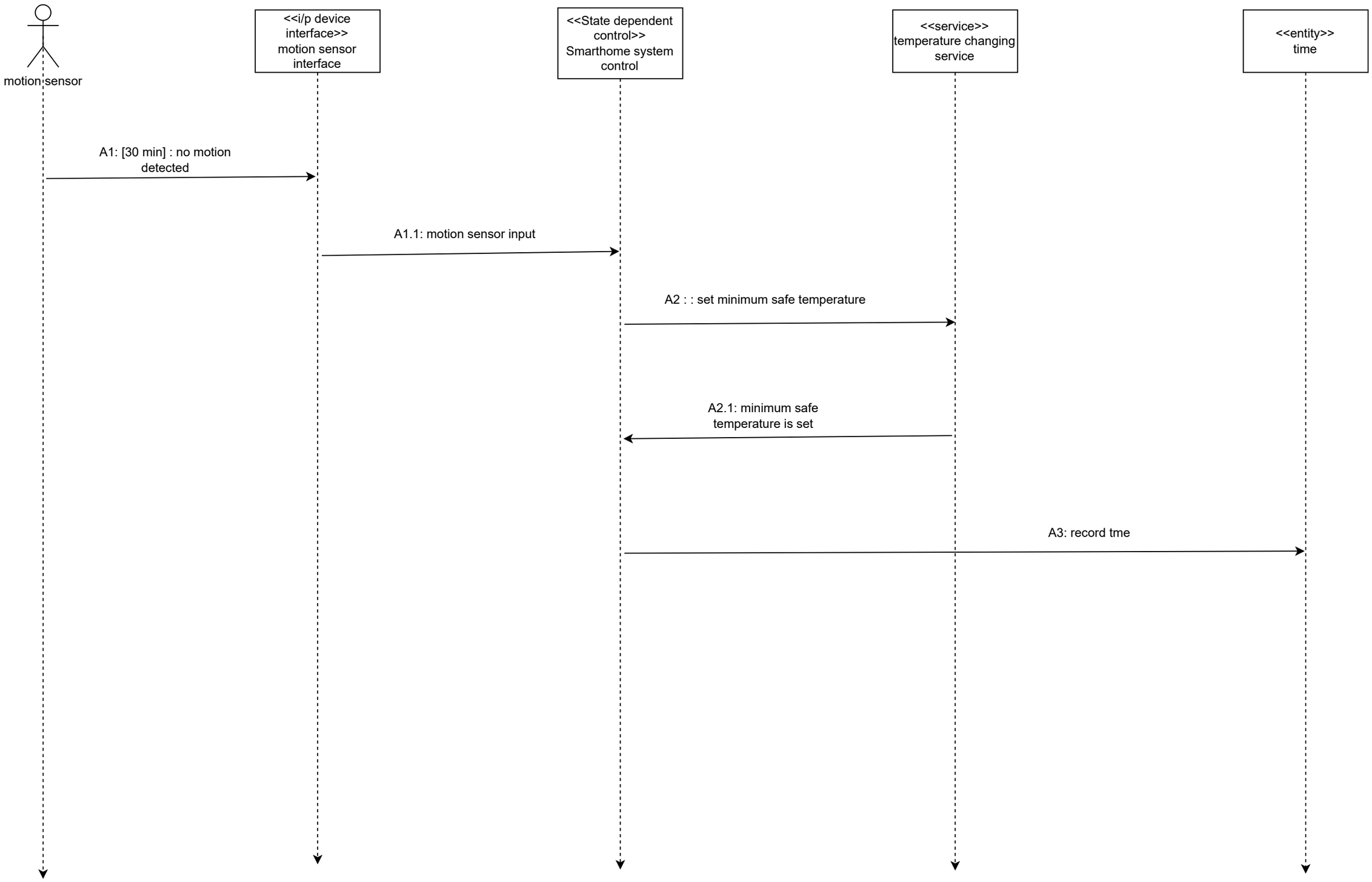
3)Temperature changing service - <<service>>

4)Time - <<entity>>

Sequence diagram for set desired temperature use case



Sequence diagram for set desired temperature use case
(alternative)



Record Automobile gas use use case:

Object structuring criteria:

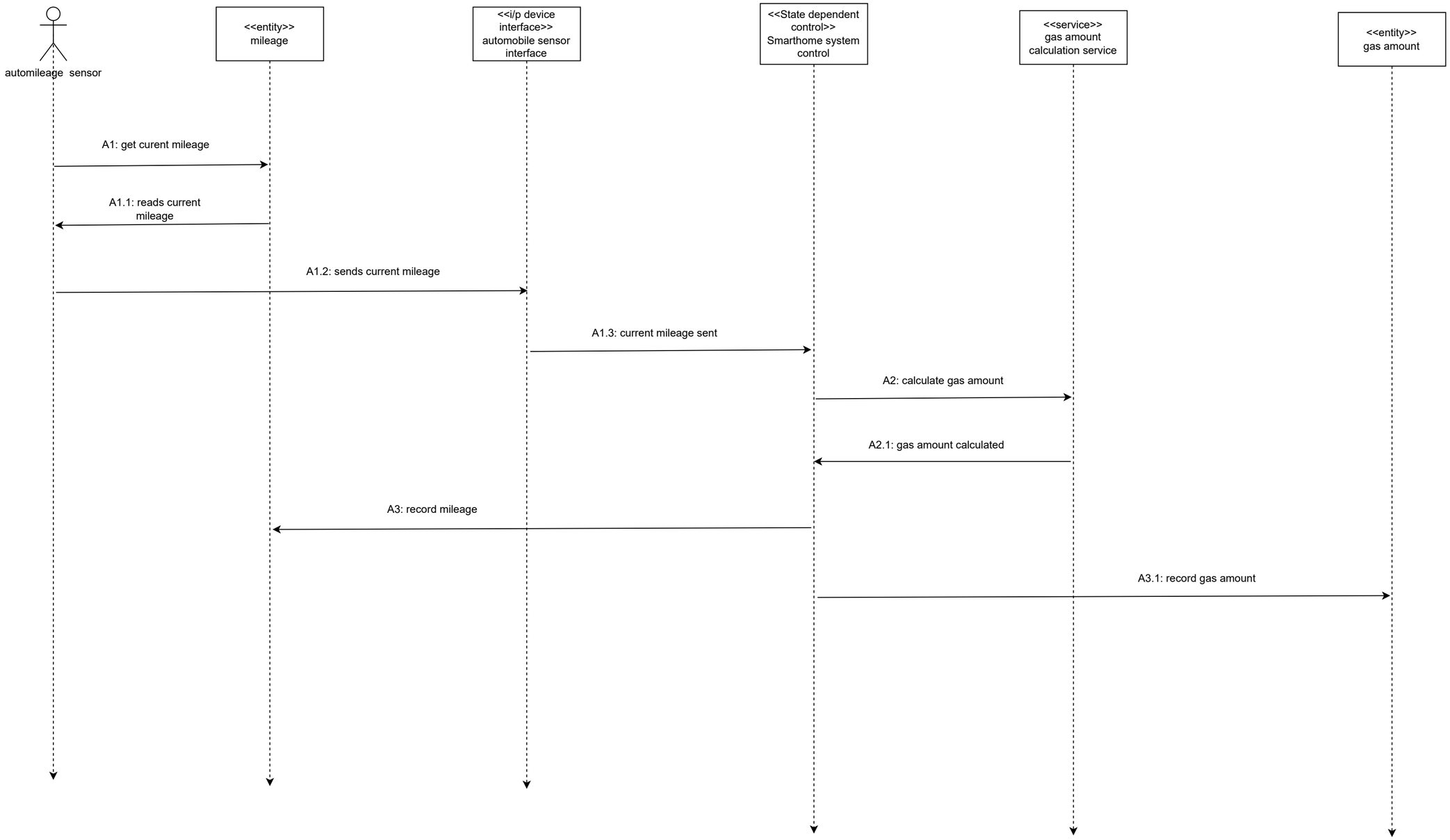
1)Smart Home system control - <<state dependent control>>

2)Auto mileage sensor interface - <<i/p device interface>>(boundary)

3)Gas amount calculation service - <<service>>

4)Mileage - <<entity>>

5)Gas amount - <<entity>>


automileage sensor
<<entity>>
mileage
<<i/p device
interface>>
automobile sensor
interface
<<State dependent
control>>
Smarthome system
control
<<service>>
gas amount
calculation service
<<entity>>
gas amount
A1: get curent mileage
A1.1: reads current
mileage
A1.2: sends current mileage
A1.3: current mileage sent
A2: calculate gas amount
A2.1: gas amount calculated
A3: record mileage
A3.1: record gas amount

Light On/Off use case:

Object structuring criteria:

1)Smart Home system control - <<state dependent control>>

2)Motion sensor interface - <<i/p device interface>>(boundary)

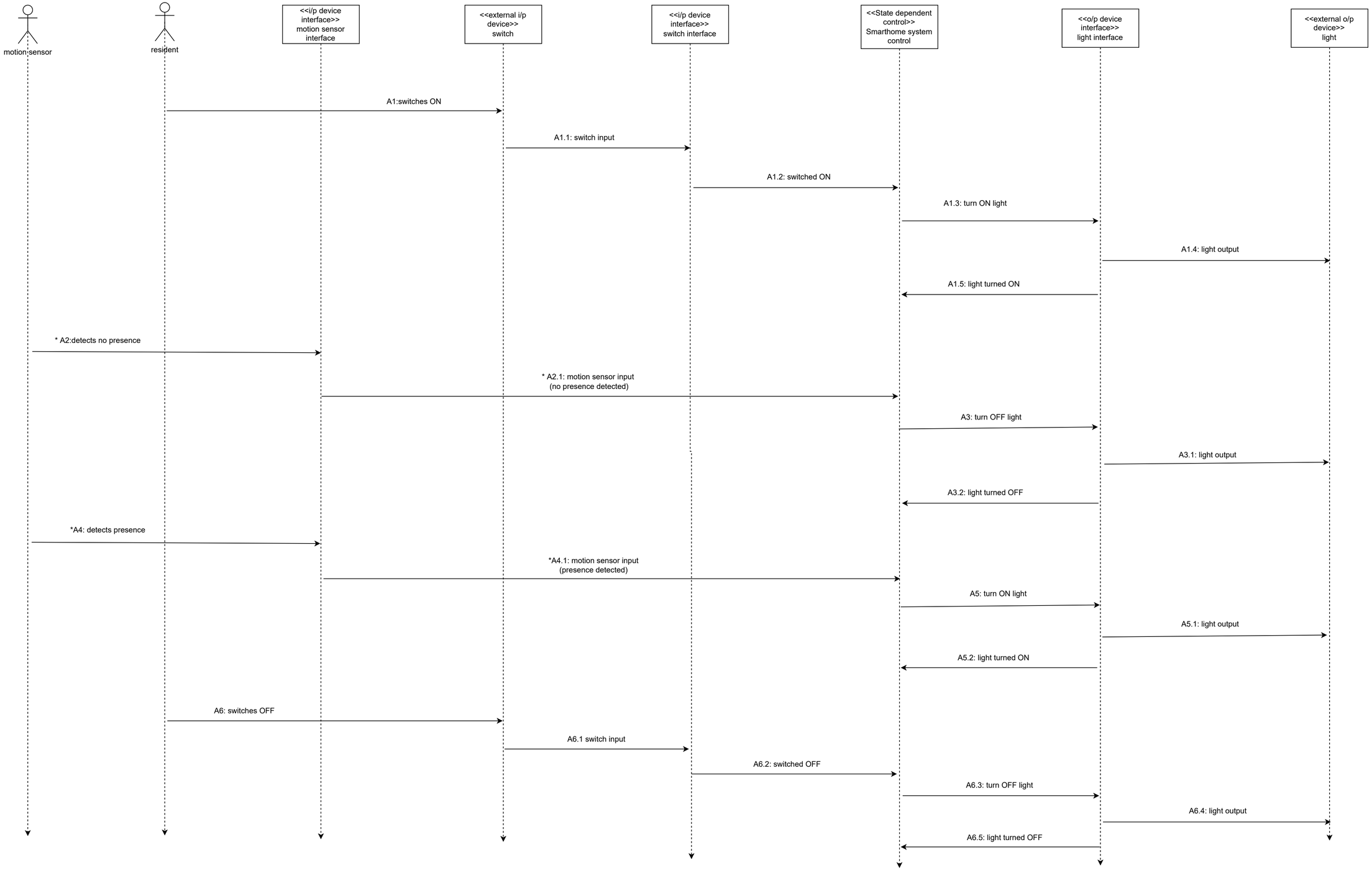
3)Switch - <<external i/p device>>

4)Switch interface - <<i/p device interface>>(boundary)

5)Light - <<external o/p device>>

6)Light interface - <<o/p device interface>>

Fig - sequence diagram for Light on / off usecase



Monitor Water Leak use case:

Object structuring criteria:

1)Smart Home system control - <<state dependent control>>

2)Water leak sensor interface - <<i/p device interface>>(boundary)

3)Smart phone - <<external o/p device>>

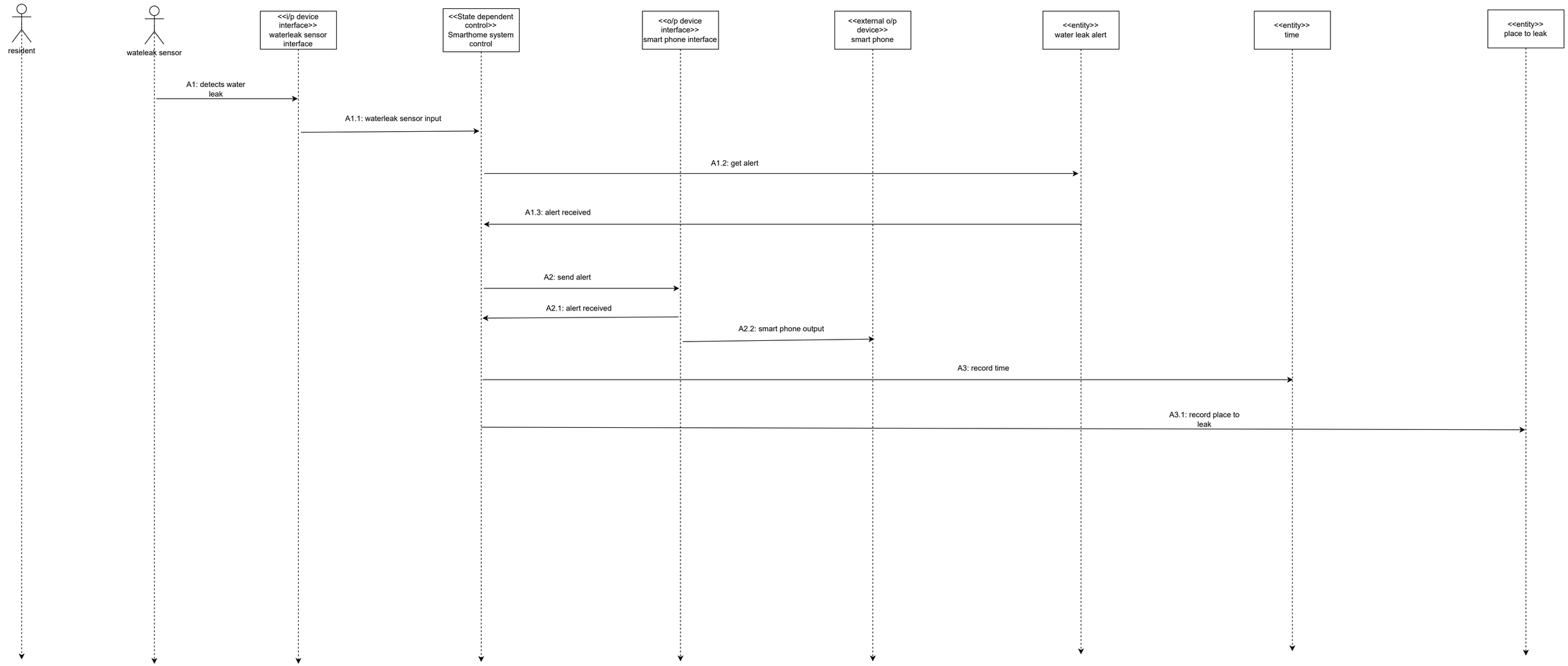
4)Smart phone interface - <<o/p device interface>>(boundary)

5)Water leak alert - <<entity>>

6)Time - <<entity>>

7)Place to leak - <<entity>>

Fig - sequence diagram for monitor water leak use case



Detect Fire use case:

Object structuring criteria:

1)Smart Home system control - <<state dependent control>>

2)Smoke detector interface - <<i/p device interface>>(boundary)

3)Fire Alarm - <<external o/p device>>

4)Fire Alarm interface - <<o/p device interface>>(boundary)

5)Sprinkler - <<external o/p device>>

6)Sprinkler interface - <<o/p device interface>>(boundary)

7)Smart phone - <<external o/p device>>

8)Smart phone interface - <<o/p device interface>>(boundary)

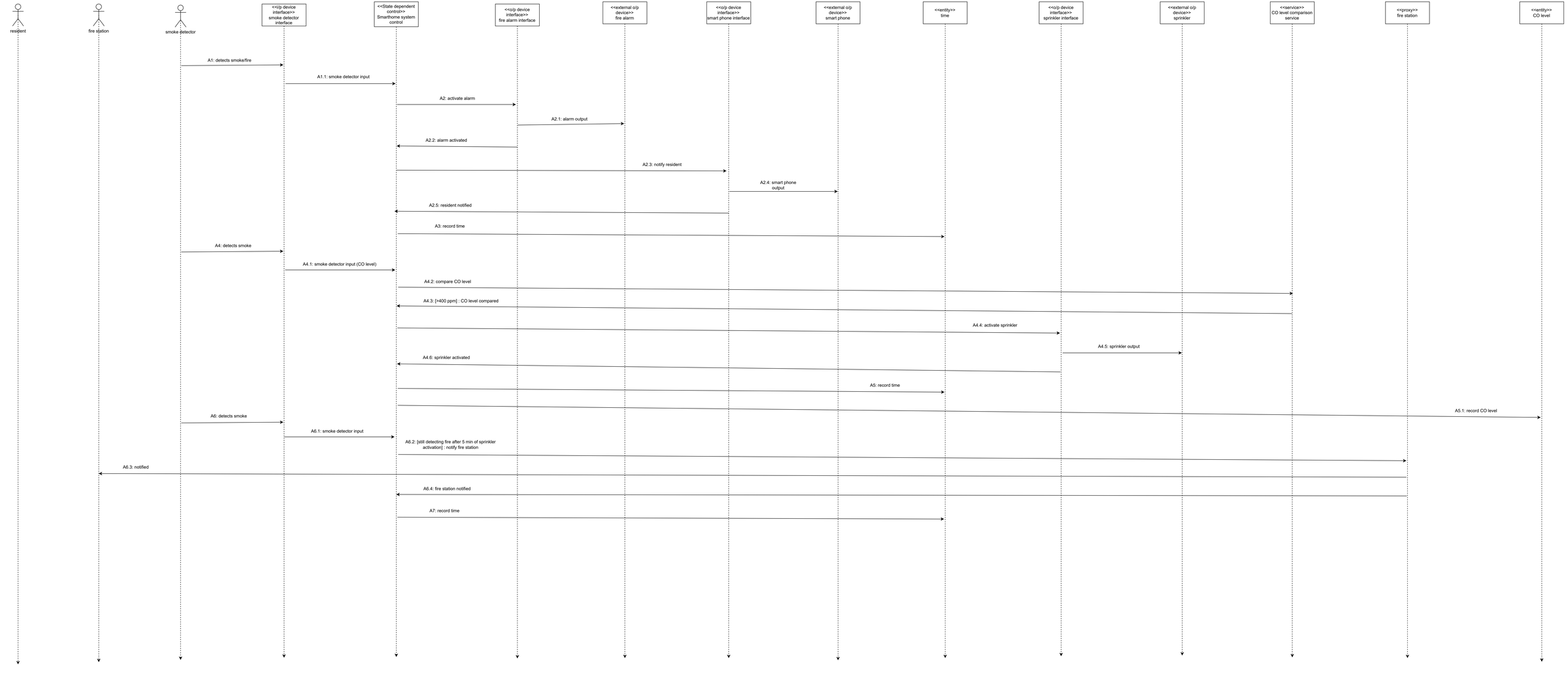
9)Fire station - <<proxy>>

10)Time- <<entity>>

11)CO level - <<entity>>

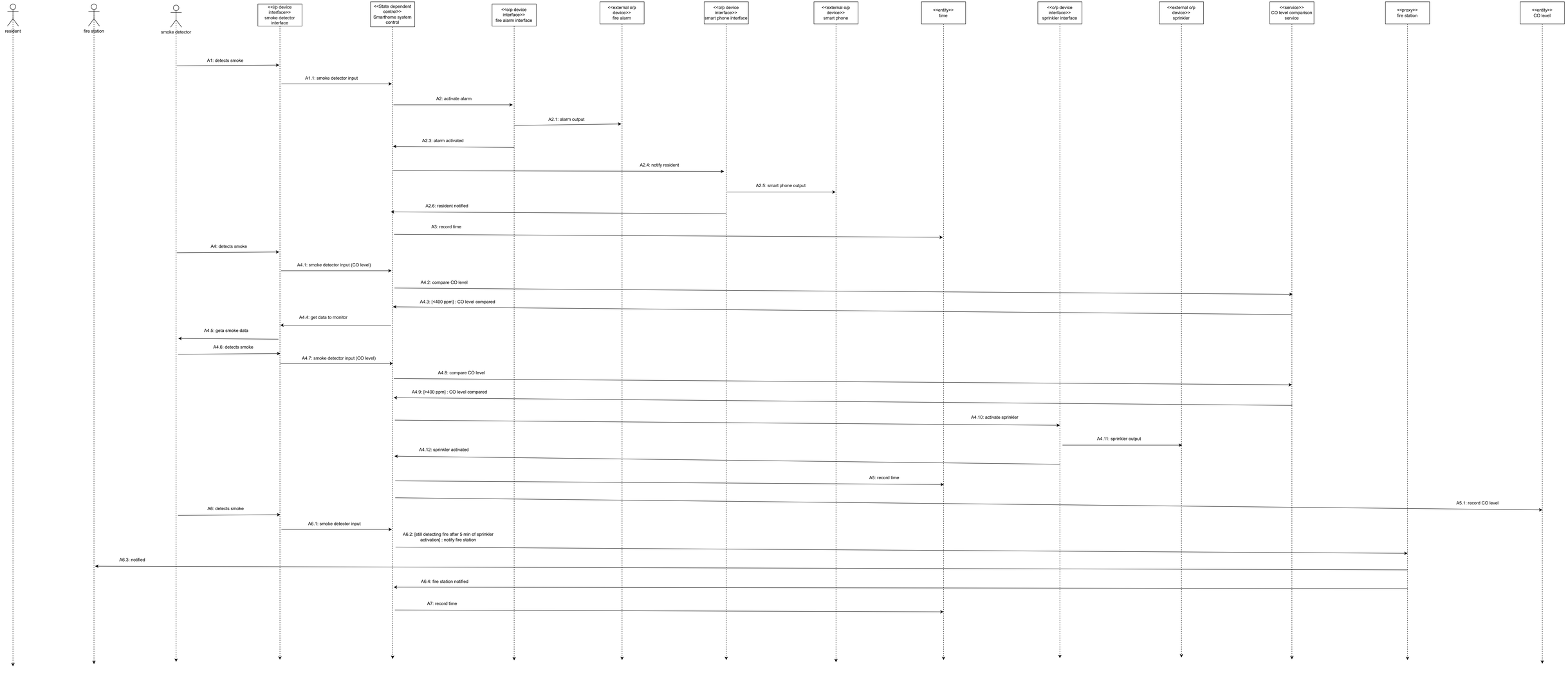
12)CO level comparison service - <<service>>

Fig - sequence diagram for detect fire usecase



SEQUENCE DIAGRAM FOR DETECT FIRE USE CASE (ALTERNATIVE)

Fig - sequence diagram for detect fire usecase



Home Security use case:

Object structuring criteria:

1)Smart Home system control - <<state dependent control>>

2)Camera interface - <<i/p device interface>>

3)Image - <<entity>>

4)Image analyzation service - <<service>>

5)Smart phone - <<external o/p device>>

6)Smart phone interface - <<o/p device interface>>(boundary)

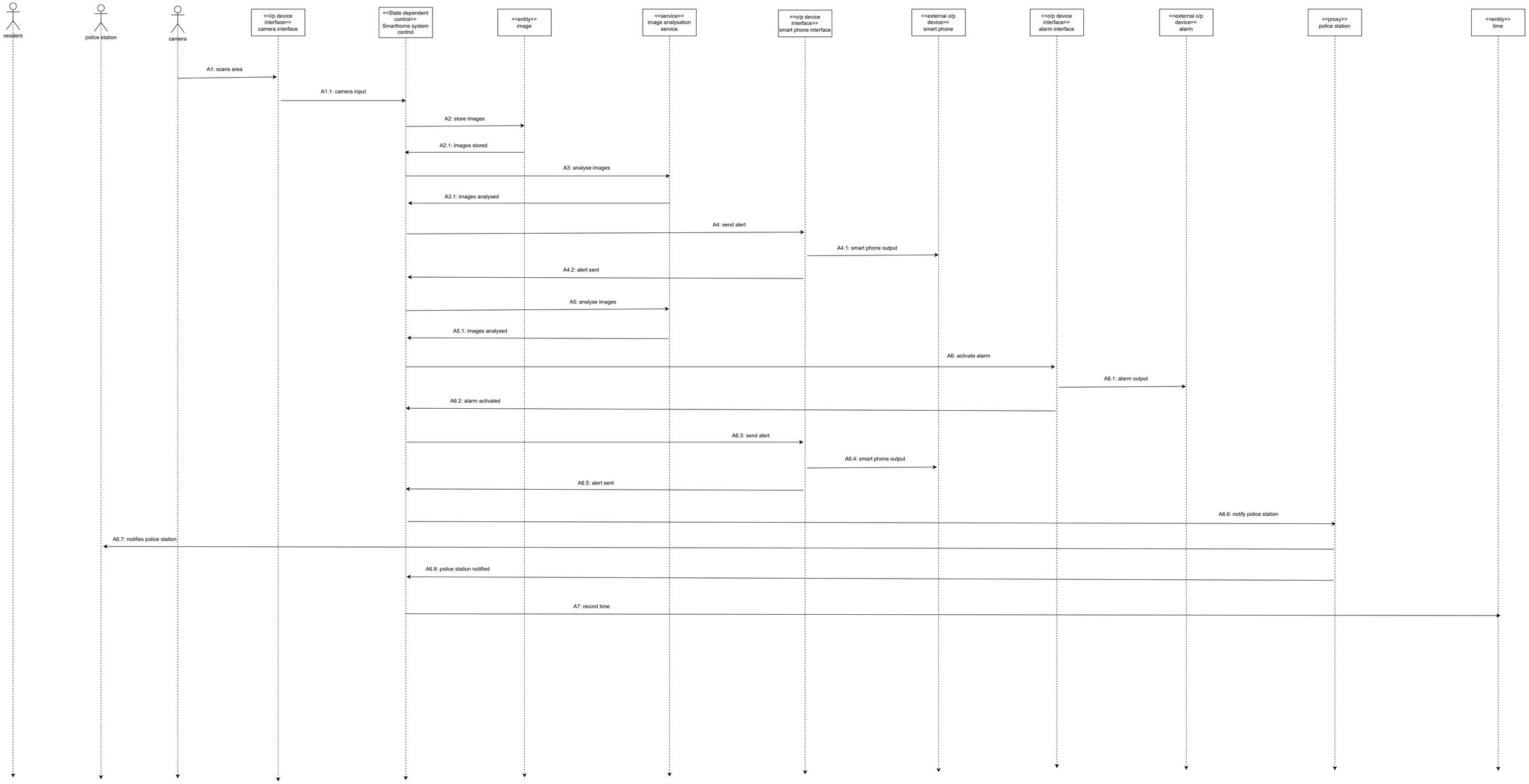
7)Alarm - <<external o/p device>>

8)Alarm interface - <<o/p device interface>>(boundary)

9)Police station - <<proxy>>

10)Time - <<entity>>

Fig - sequence diagram for home security usecase



Login use case:

Object structuring criteria:

1)Smart Home system control - <<state dependent control>>

2)Keypad display - <<external user>>

3)Keypad display interface - <<user interaction>>

4)Credentials verification service - <<service>>

5)Welcome message - <<entity>>

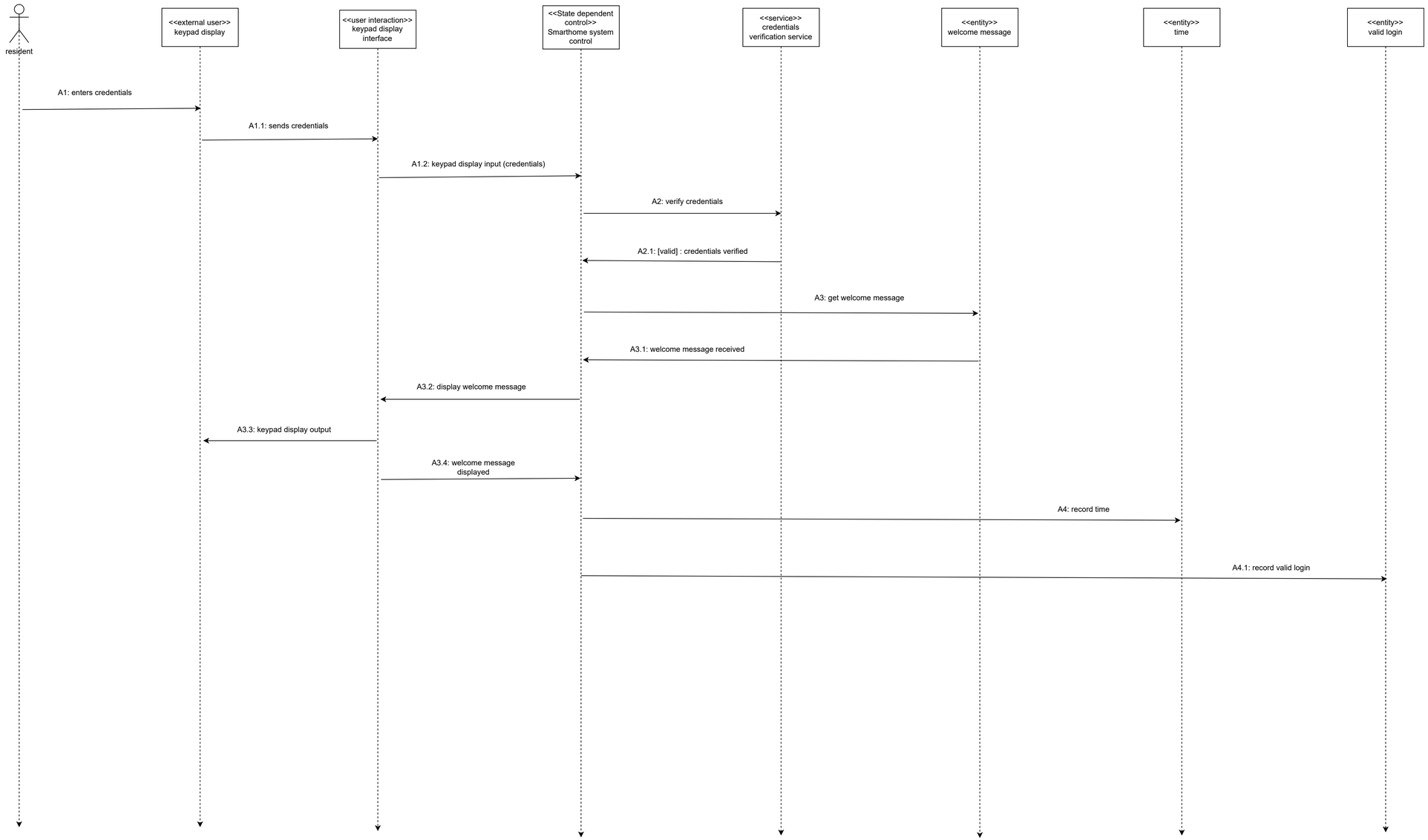
6)Error message - <<entity>>

7)Valid login - <<entity>>

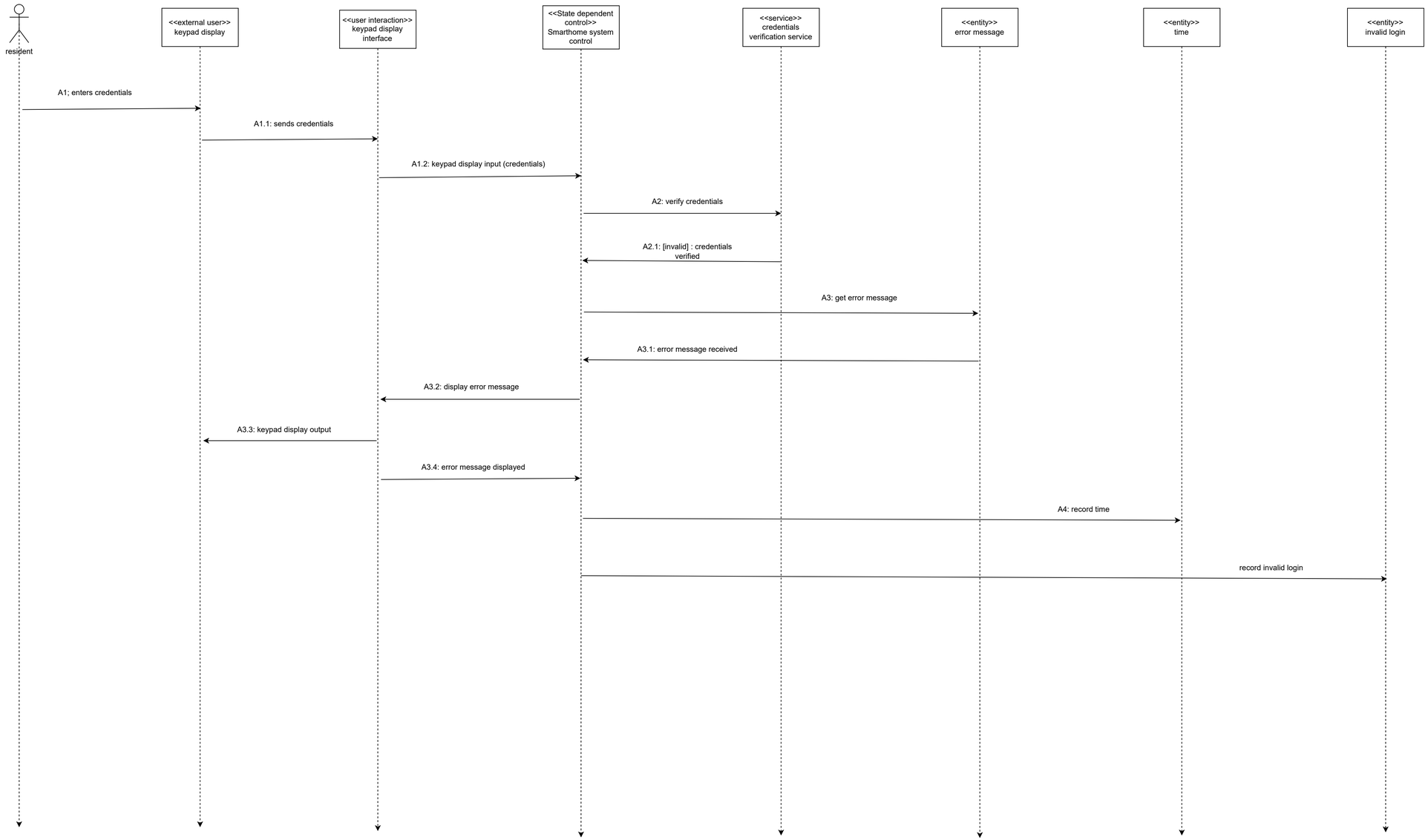
8)Invalid login - <<entity>>

9)Time - <<entity>>

LOGIN USECASE SEQUENCE DIAGRAM


resident
<<external user>>
keypad display
<<user interaction>>
keypad display
interface
<<State dependent
control>>
Smarthome system
control
<<service>>
credentials
verification service
<<entity>>
welcome message
<<entity>>
time
<<entity>>
valid login
A1: enters credentials
A1.1: sends credentials
A1.2: keypad display input (credentials)
A2: verify credentials
A2.1: [valid] : credentials verified
A3: get welcome message
A3.1: welcome message received
A3.2: display welcome message
A3.3: keypad display output
A3.4: welcome message
displayed
A4: record time
A4.1: record valid login

LOGINUSE CASE SEQUENCE DIAGRAM (ALTERNATIVE)


resident
<<external user>>
keypad display
<<user interaction>>
keypad display
interface
<<State dependent
control>>
Smarthome system
control
<<service>>
credentials
verification service
<<entity>>
error message
<<entity>>
time
<<entity>>
invalid login
A1; enters credentials
A1.1: sends credentials
A1.2: keypad display input (credentials)
A2: verify credentials
A2.1: [invalid] : credentials
verified
A3: get error message
A3.1: error message received
A3.2: display error message
A3.3: keypad display output
A3.4: error message displayed
A4: record time
record invalid login

View/Change Values use case:

Object structuring criteria:

1)Smart Home system control - <<state dependent control>>

2)Keypad display - <<external user>>

3)Keypad display interface - <<user interaction>>

4)Home status - <<entity>>

5)Menu - <<entity>>

6)Time - <<entity>>

7)Temperature - <<entity>>

Fig - sequence diagram for view/change values usecase

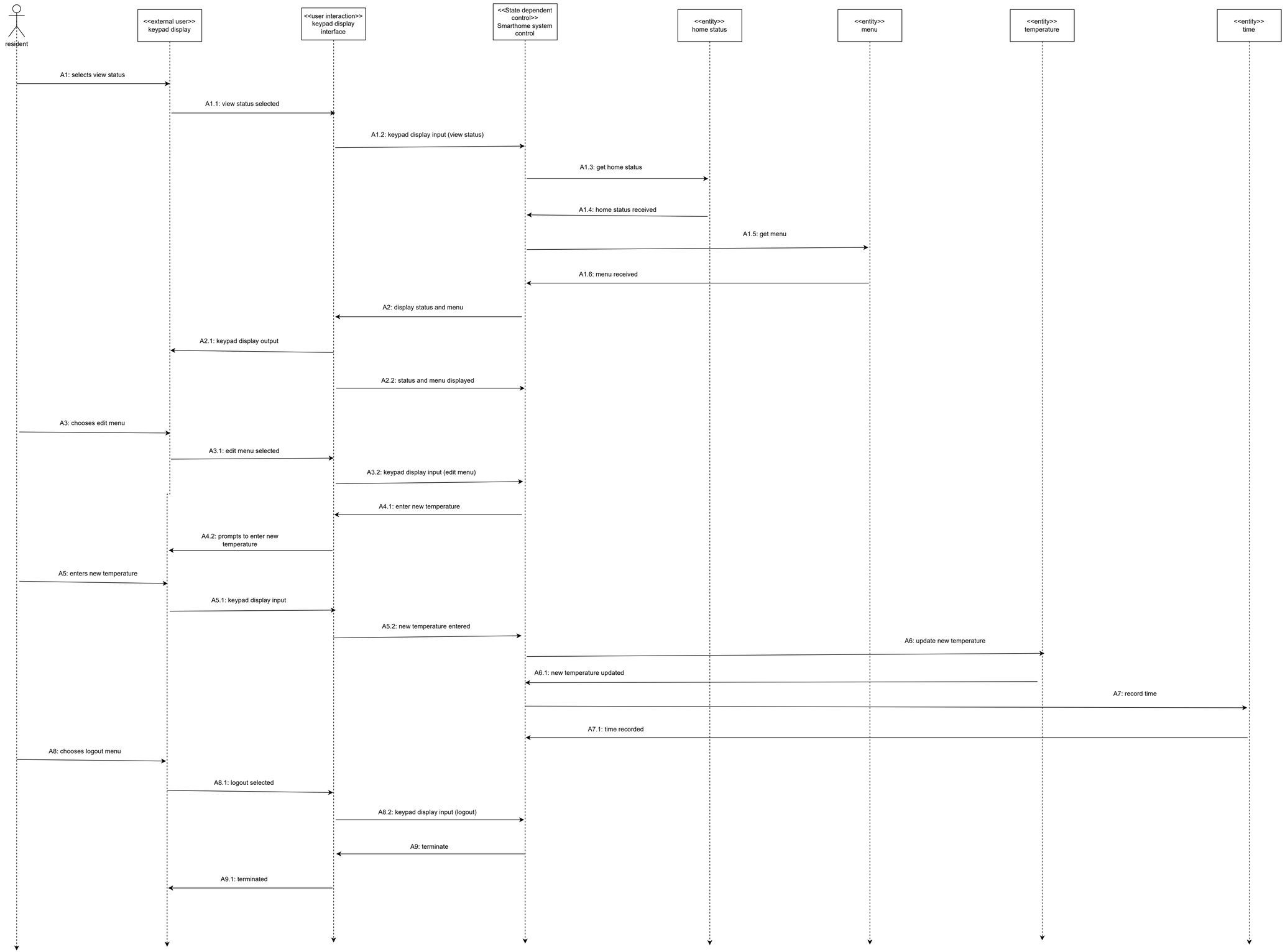
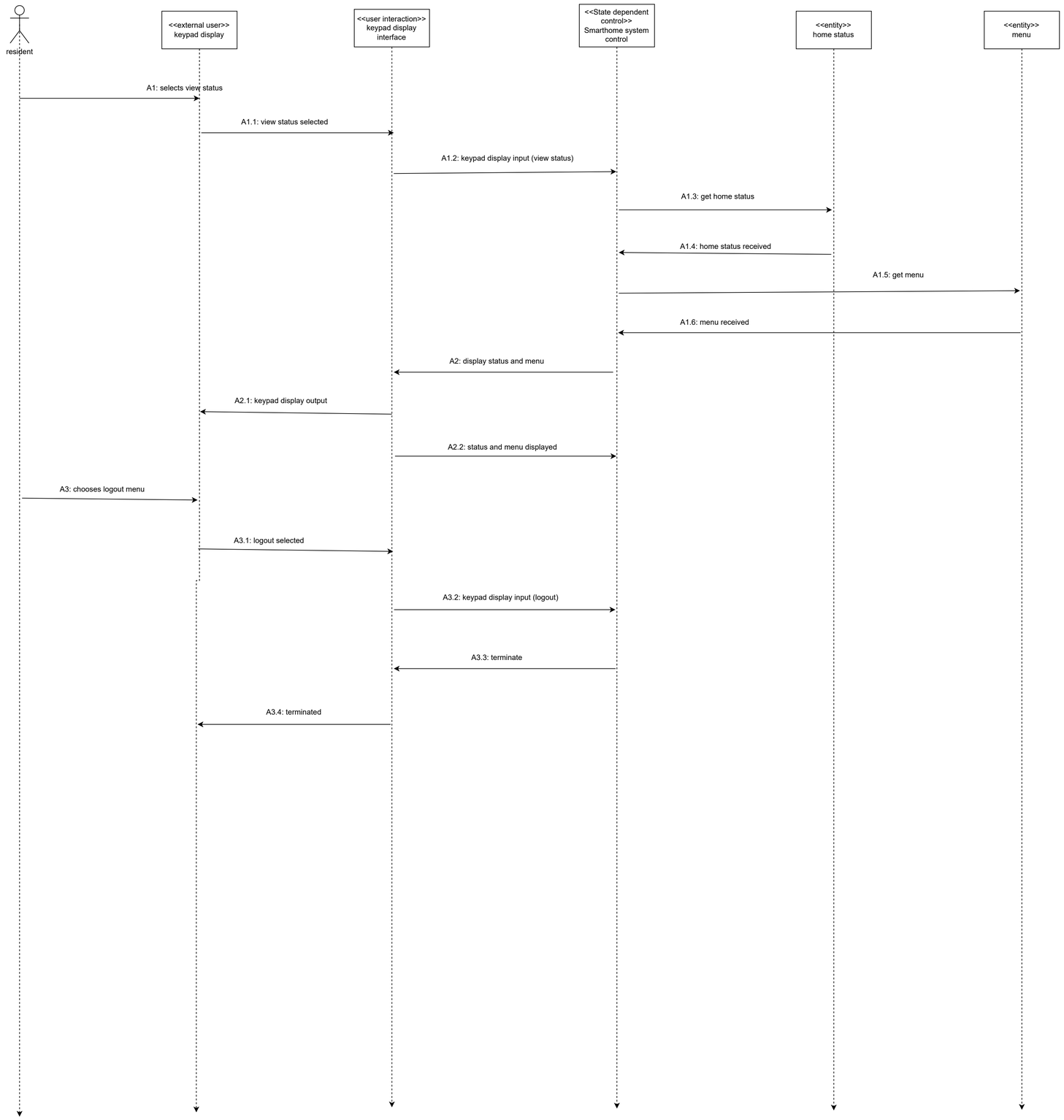


Fig - sequence diagram for view/change values usecase (alternative)



Record Electricity Use and Bill use case:

Object structuring criteria:

1)Smart Home system control - <<state dependent control>>

2)Record timer - <<timer>>

3)Smarthome blockchain ledger - <<entity>>

4)EC blockchain ledger - <<entity>>

5)LC blockchain ledger - <<entity>>

6)Discount rates - <<entity>>

7)Error message - <<entity>>

8)EC - <<proxy>>

9)LC - <<proxy>>

10)Electricity bill calculation service - <<service>>

11)EC Verification service - <<service>>

Fig - sequence diagram for record electricity usecase

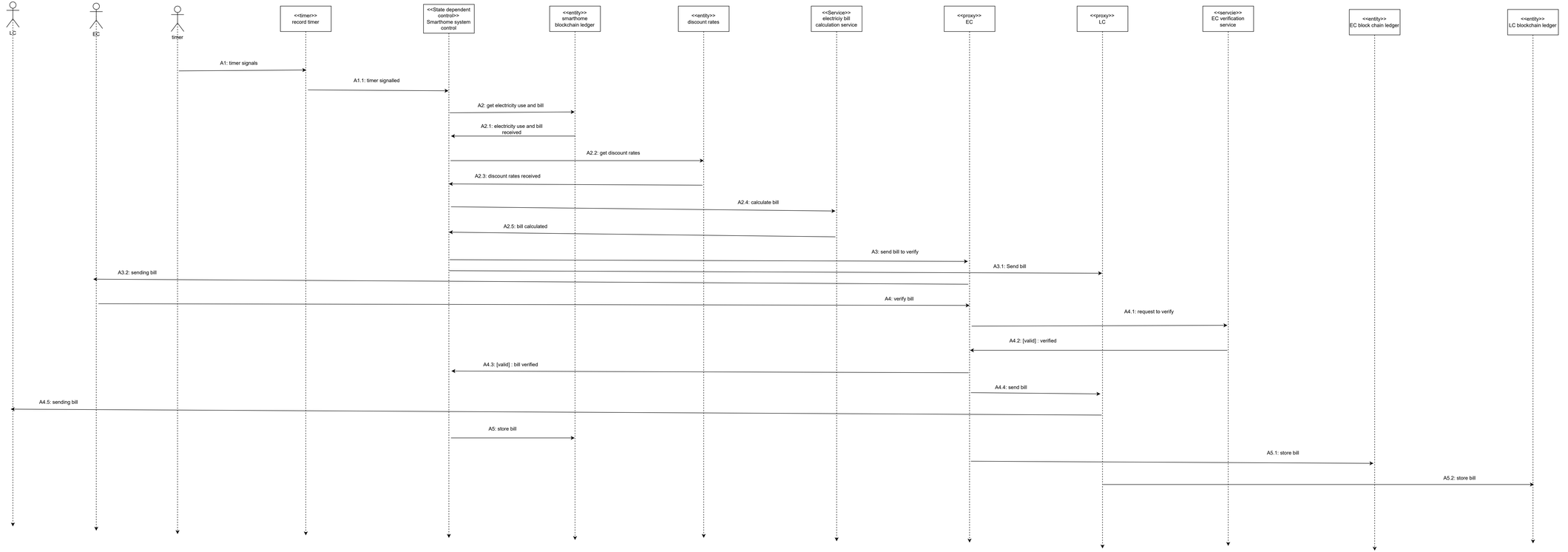
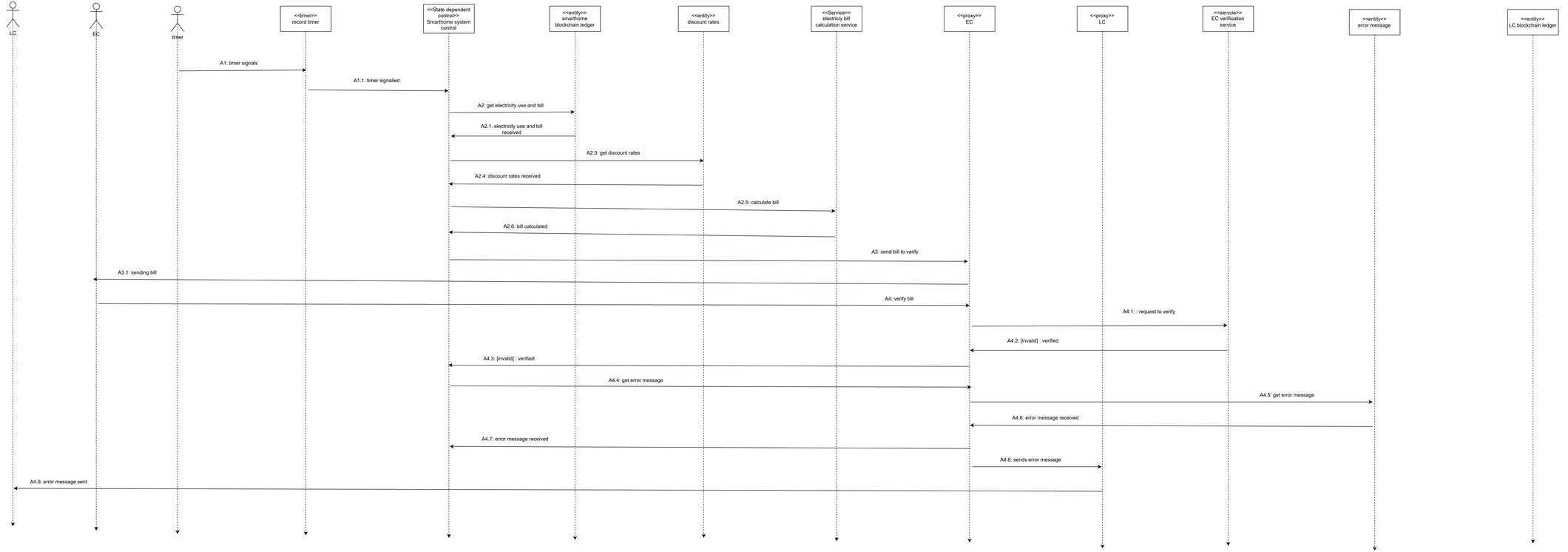


Fig - sequence diagram for record electricity usecase(alternative)



View Electricity Use and Bill use case:

Object structuring criteria:

1)Smart Home system control - <<state dependent control>>

2)Keypad display - <<external user>>

3)Keypad display interface - <<user interaction>>

4)Smart home blockchain ledger - <<entity>>

5)Period - <<entity>>

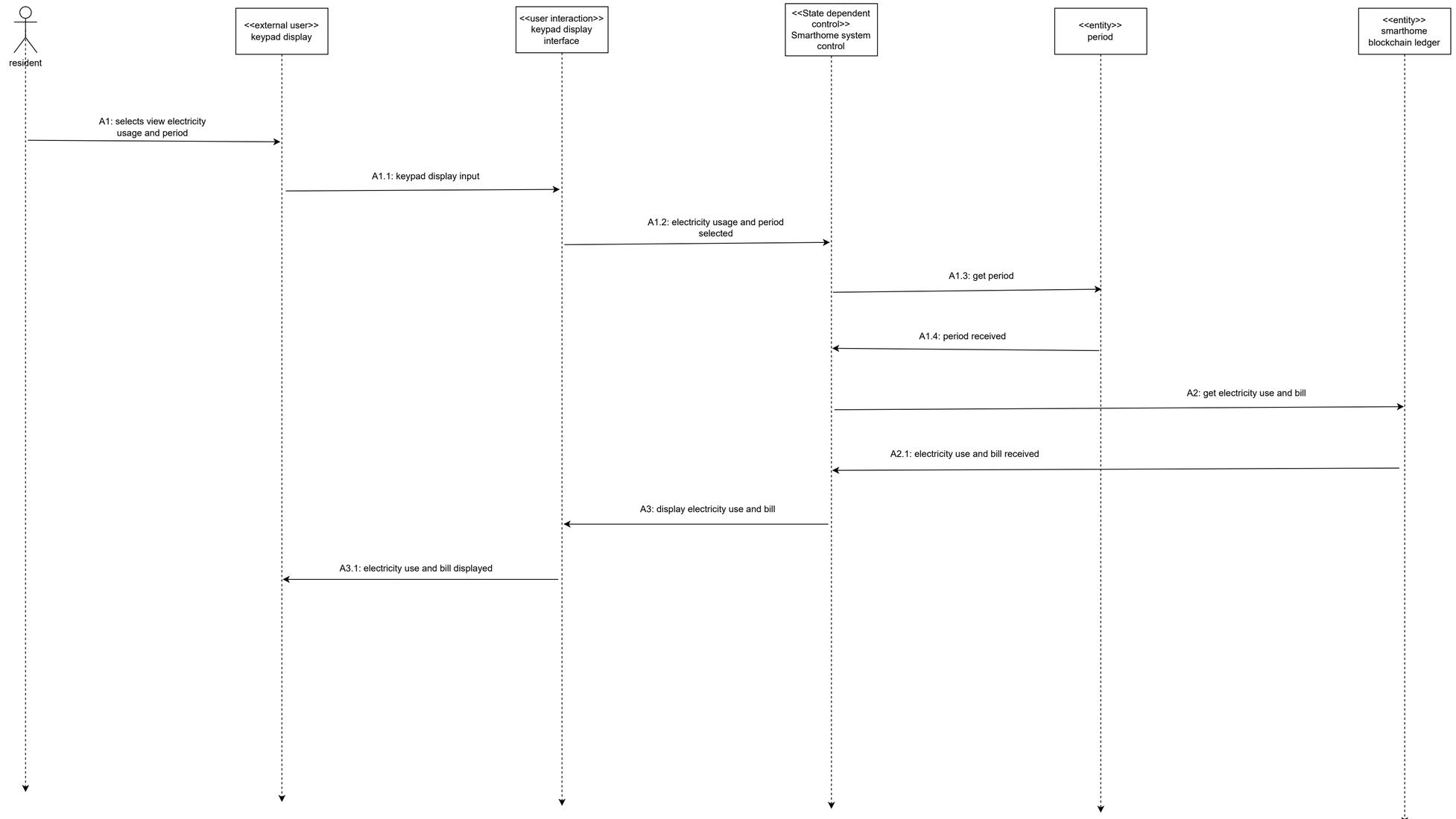

resident
<<external user>>
keypad display
<<user interaction>>
keypad display
interface
<<State dependent
control>>
Smarthome system
control
<<entity>>
period
<<entity>>
smarthome
blockchain ledger
A1: selects view electricity
usage and period
A1.1: keypad display input
A1.2: electricity usage and period
selected
A1.3: get period
A1.4: period received
A2: get electricity use and bill
A2.1: electricity use and bill received
A3: display electricity use and bill
A3.1: electricity use and bill displayed

Fig - staechart for control temperature usecase

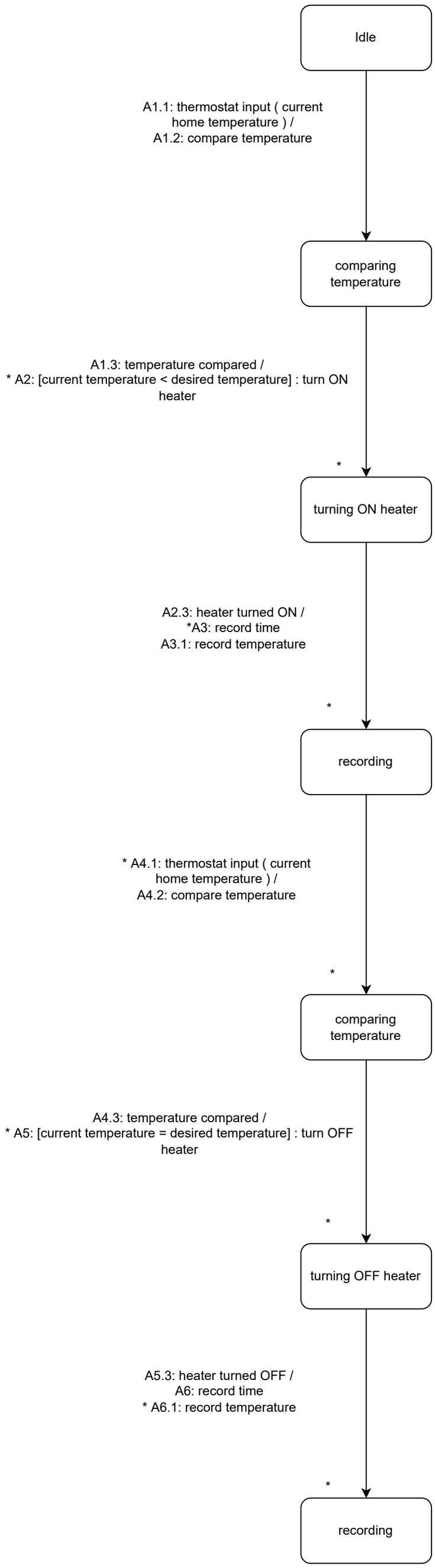


Fig - staechart for control temperature usecase (alternative)

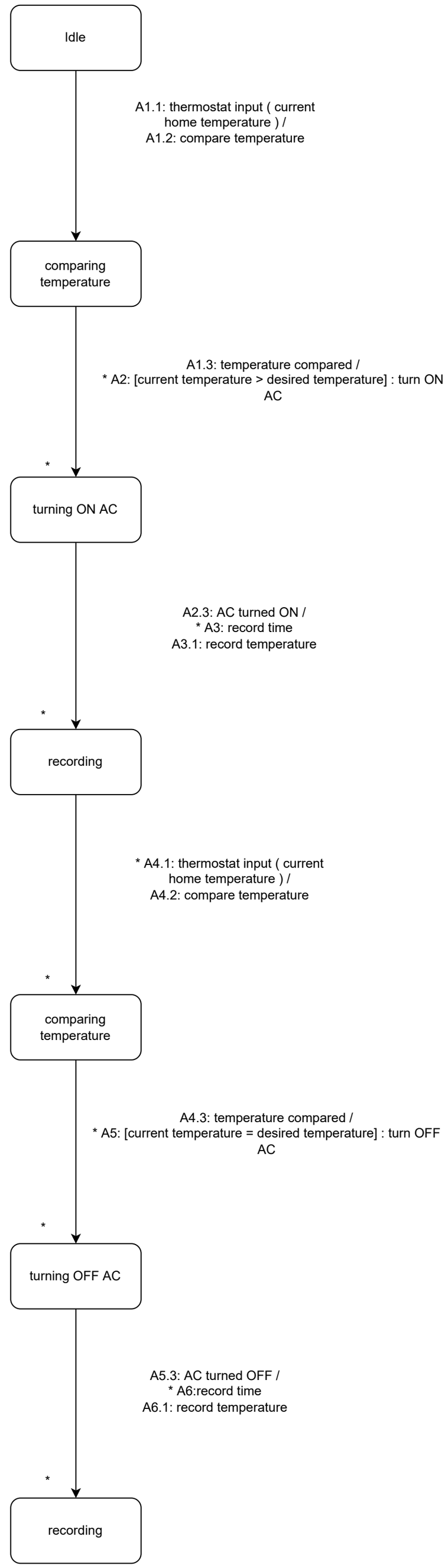


Fig - statechart for set desired temperature use case

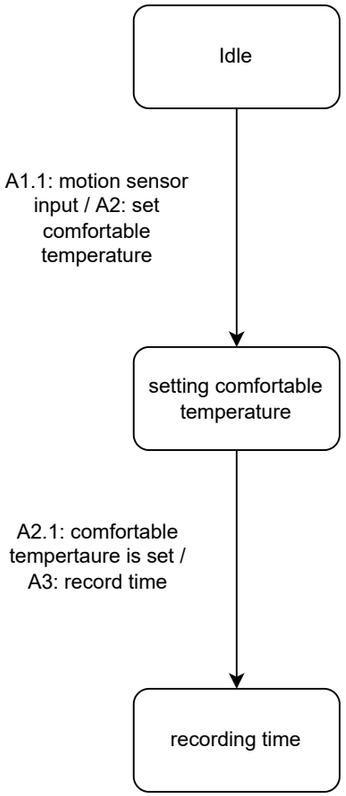


Fig - statechart for set desired temperature use case (alternative)

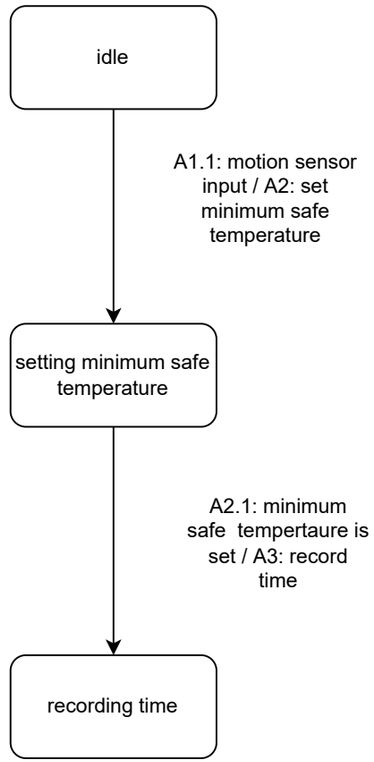


Fig - statechart for record automobile gas use use case

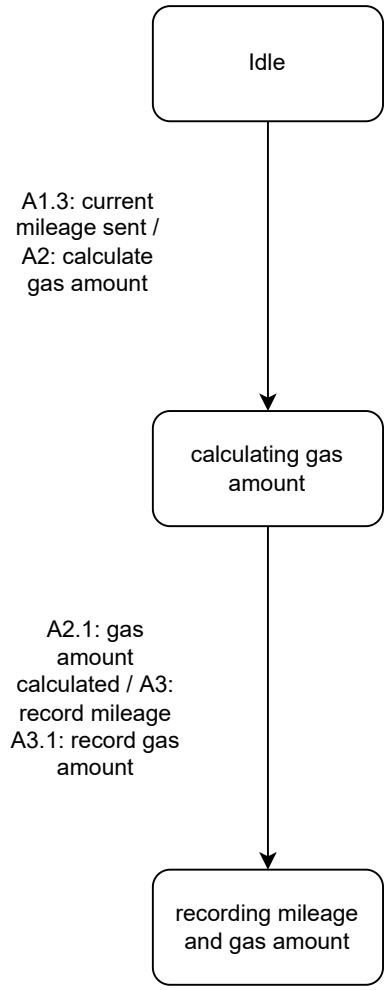


Fig - statechart for Light on / off usecase

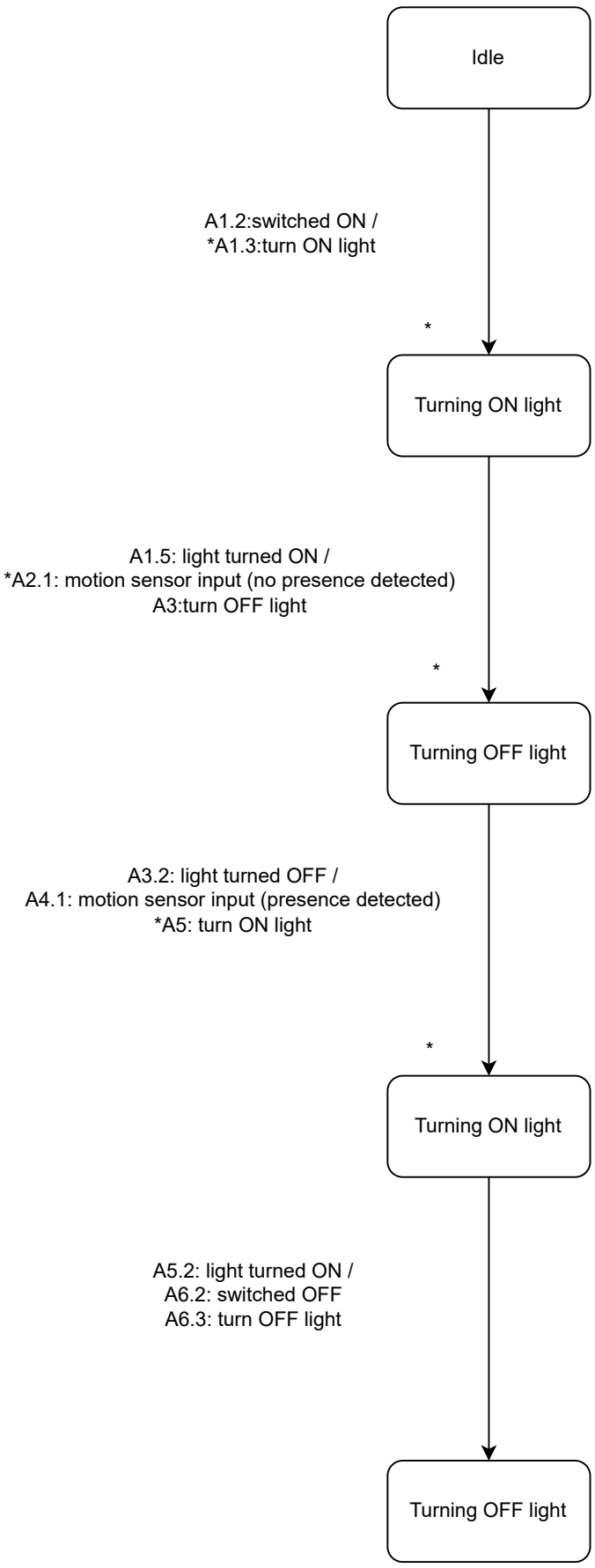


Fig - state chart for monitor water leak use case

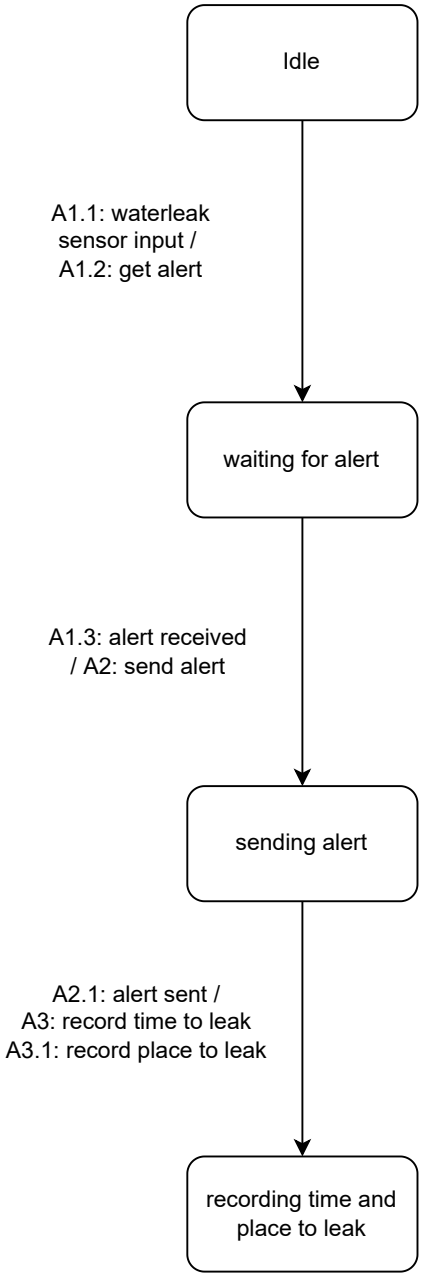


Fig - statechart for detect fire usecase

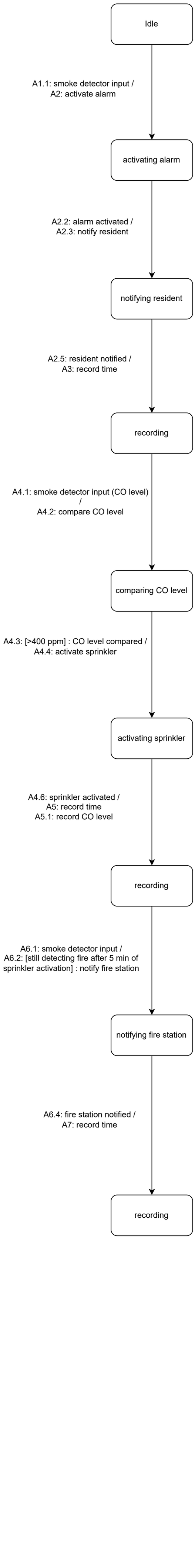


Fig - statechart for detect fire usecase
(alternative)

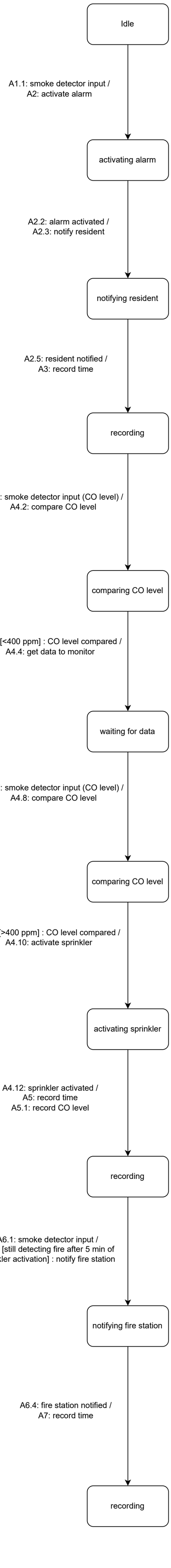


Fig - statechart for home security usecase

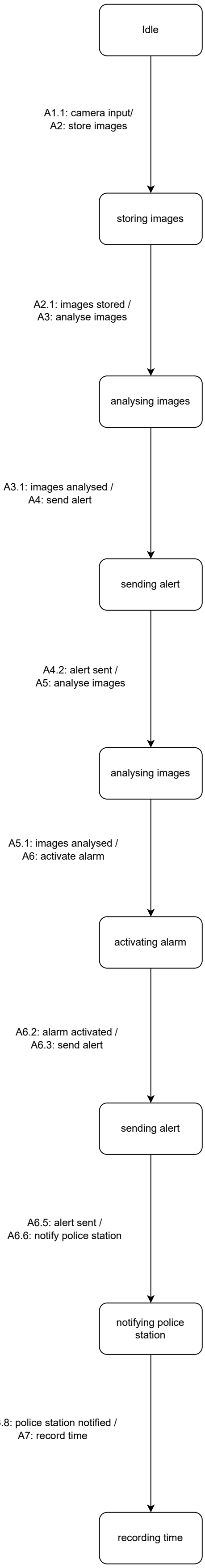


Fig - statechart for login usecase

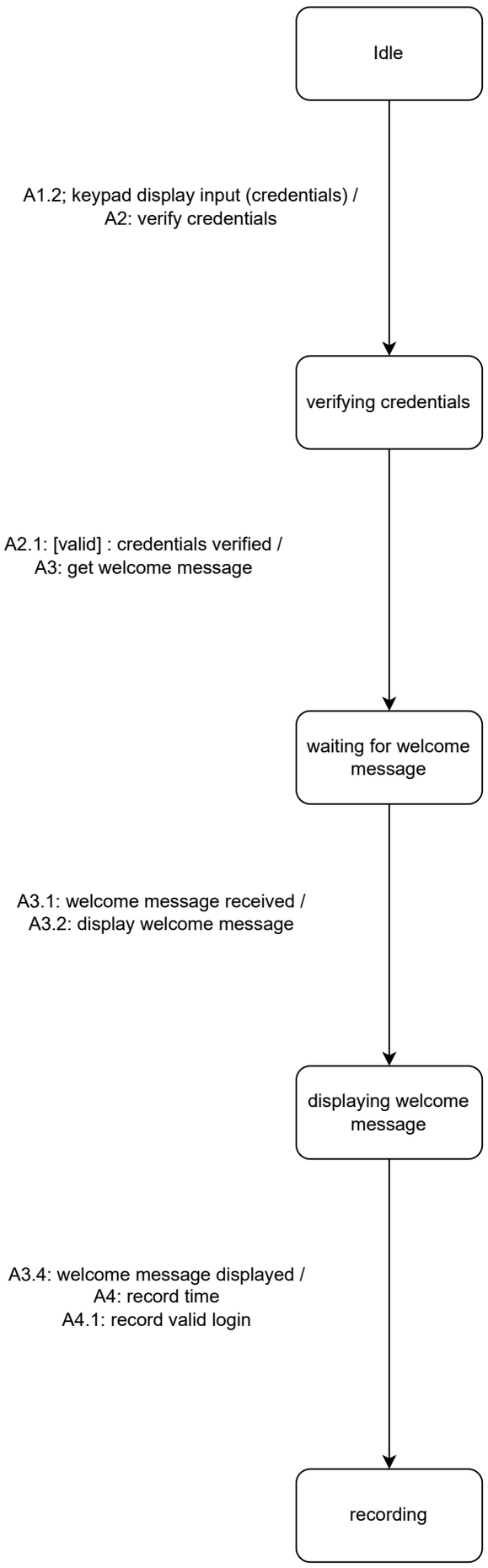


Fig - staechart for login usecase (alternative)

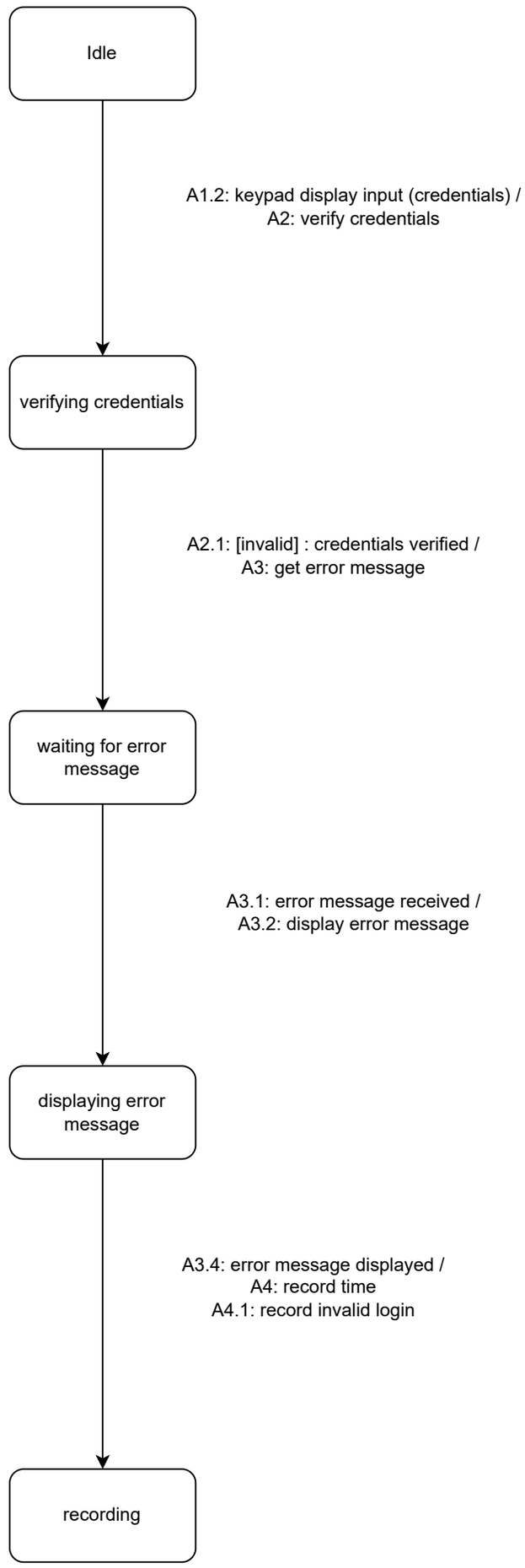


Fig - statechart for view/change values usecase

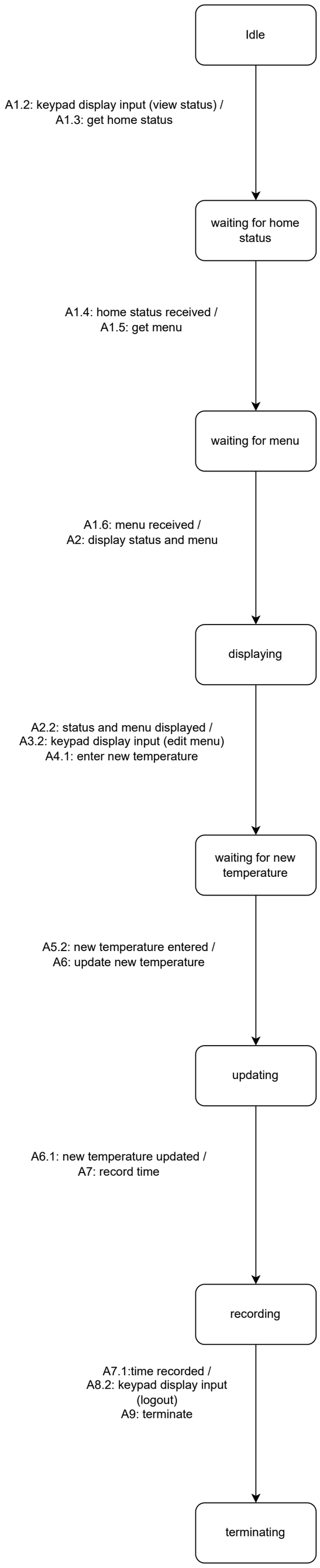


Fig - statechart for view/change values usecase (alternative)

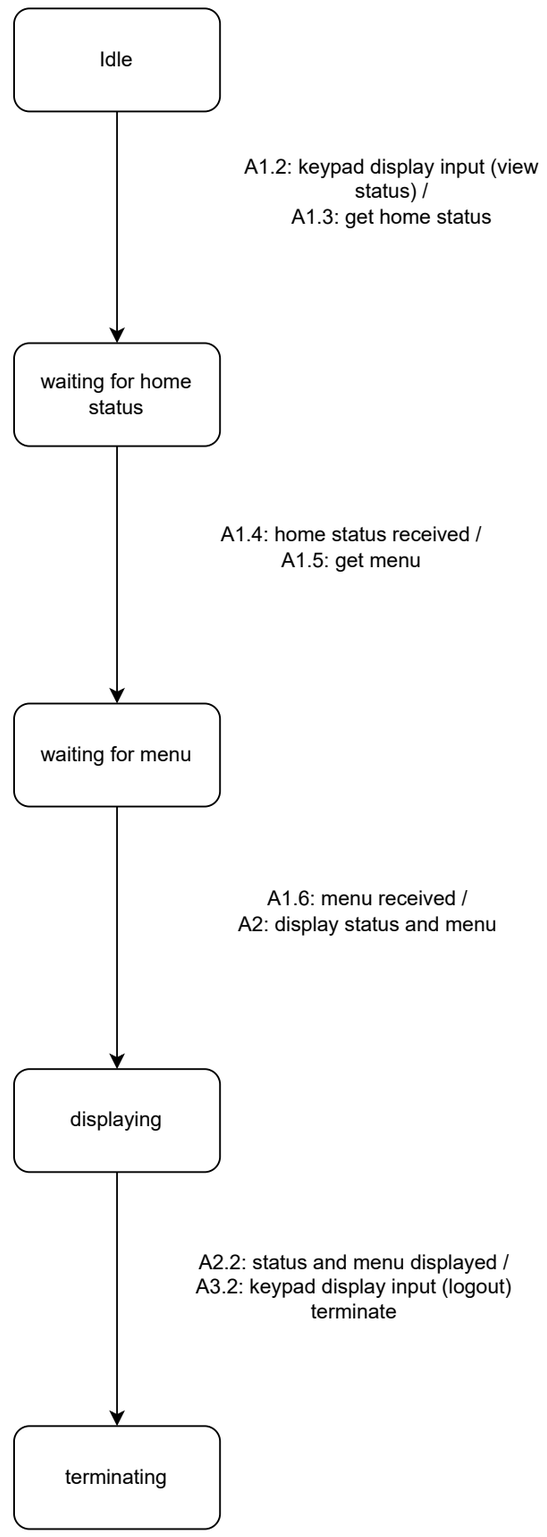


Fig - statechart for record electricity usecase

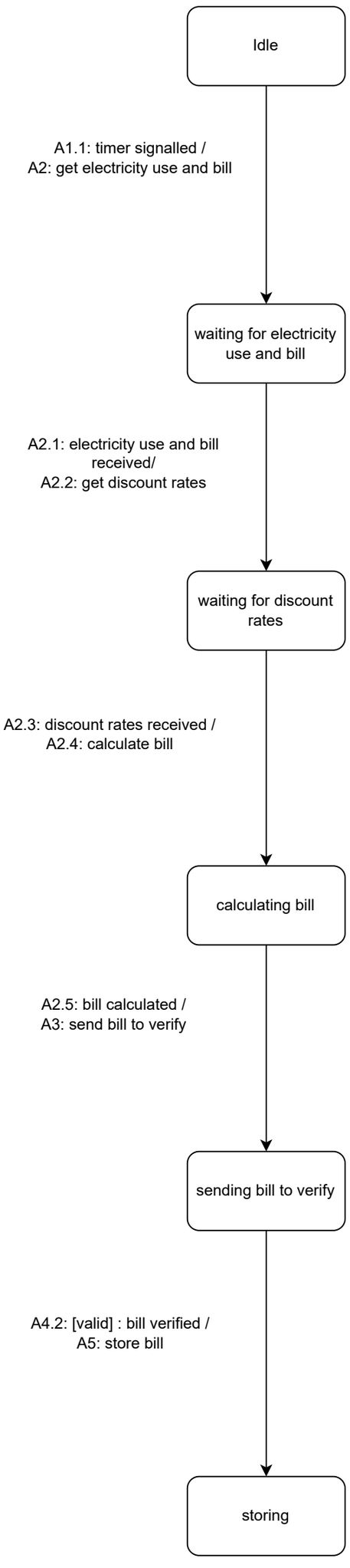


Fig - statechart for record electricity usecase (alternative)

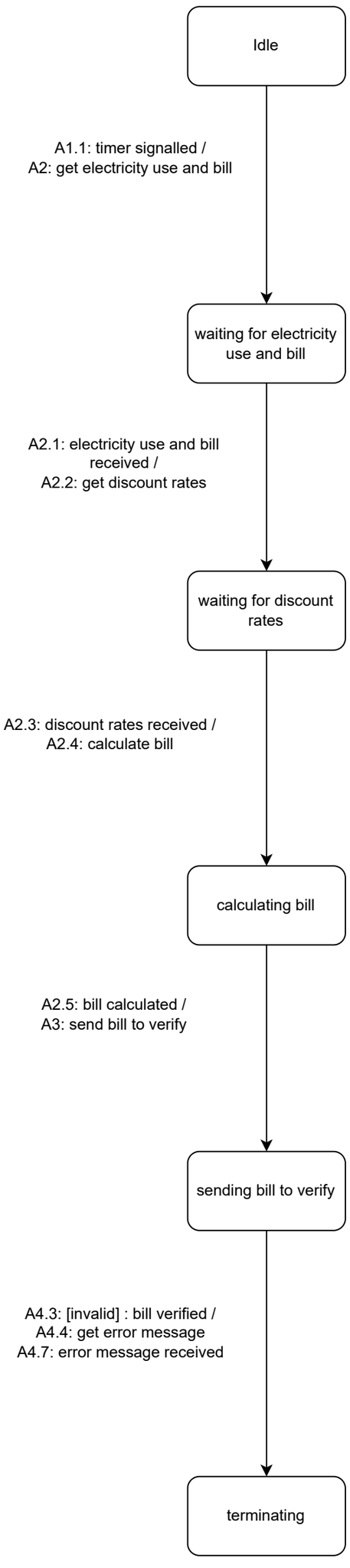
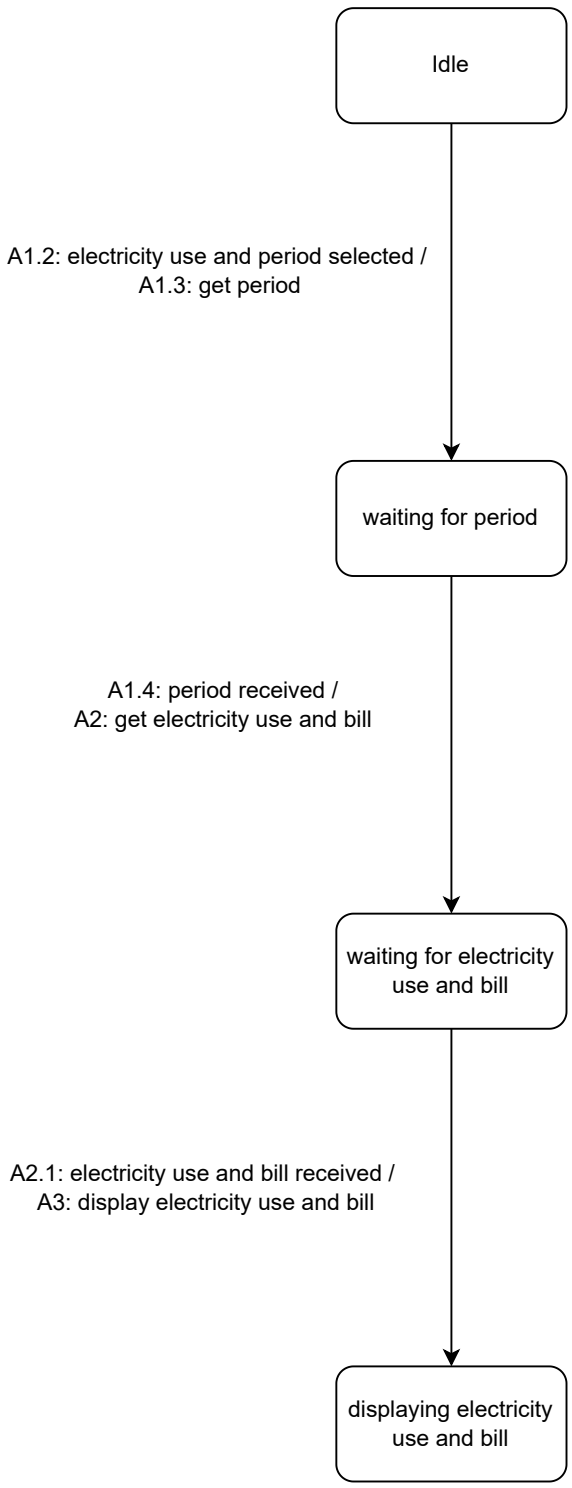
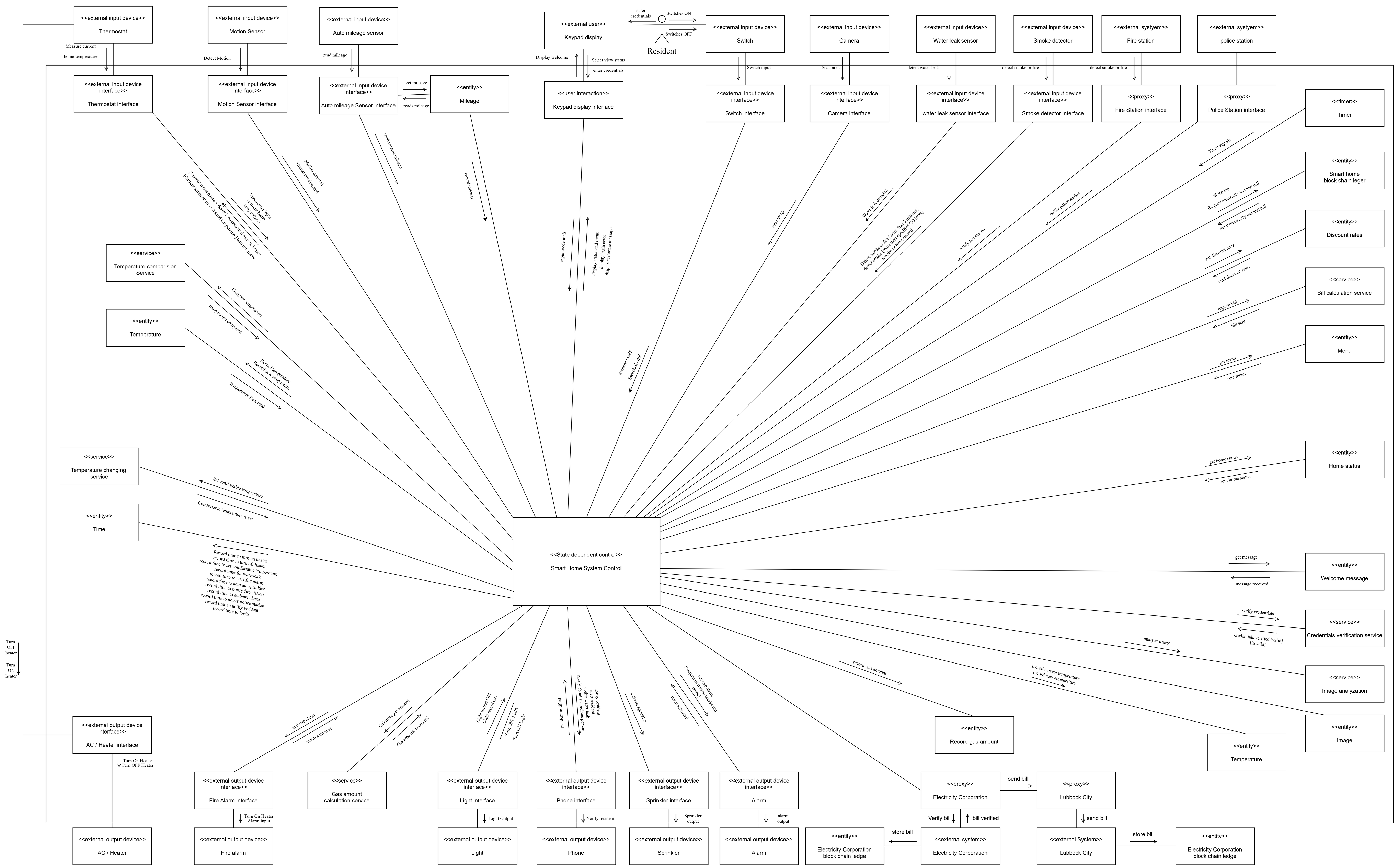


Fig - statechart for view electricity use and bill use case



PHASE 2

A) Communication diagram



<<external input device>> Thermostat
<<external input device>> Motion Sensor
<<external input device>> Auto mileage sensor
<<external user>> Keypad display
Resident
<<external input device>> Switch
<<external input device>> Camera
<<external input device>> Water leak sensor
<<external input device>> Smoke detector
<<external system>> Fire station
<<external system>> police station
<<external input device interface>> Thermostat interface
<<external input device interface>> Motion Sensor interface
<<external input device interface>> Auto mileage Sensor interface
<<entity>> Mileage
<<user interaction>> Keypad display interface
<<external input device interface>> Switch interface
<<external input device interface>> Camera interface
<<external input device interface>> water leak sensor interface
<<external input device interface>> Smoke detector interface
<<proxy>> Fire Station interface
<<proxy>> Police Station interface
<<timer>> Timer
<<entity>> Smart home block chain leger
<<entity>> Discount rates
<<service>> Bill calculation service
<<entity>> Menu
<<service>> Temperature comparision Service
<<entity>> Temperature
<<service>> Temperature changing service
<<entity>> Time
<<entity>> Home status
<<State dependent control>> Smart Home System Control
<<entity>> Welcome message
<<service>> Credentials verification service
<<service>> Image analyzation
<<entity>> Image
<<entity>> Record gas amount
<<entity>> Temperature
<<external output device interface>> AC / Heater interface
<<external output device interface>> Fire Alarm interface
<<service>> Gas amount calculation service
<<external output device interface>> Light interface
<<external output device interface>> Phone interface
<<external output device interface>> Sprinkler interface
<<external output device interface>> Alarm
<<proxy>> Electricity Corporation
<<proxy>> Lubbock City
send bill
Verify bill
bill verified
send bill
<<external output device>> AC / Heater
<<external output device>> Fire alarm
<<external output device>> Light
<<external output device>> Phone
<<external output device>> Sprinkler
<<external output device>> Alarm
<<entity>> Electricity Corporation block chain ledge
store bill
<<external system>> Electricity Corporation
<<external System>> Lubbock City
store bill
<<entity>> Electricity Corporation block chain ledge

B) Subsystem Architecture

Sub Systen Structuring Criteria:

1. <<Input output Subsystem>>:

[contains input devices Thermostat, Motion sensor, Auto Mileage Sensor, Switch, Camera, Water leak sensor, Smoke detector and output devices Smart Phone, Light, Fire alarm, Sprinkler, Alarm, and AC/Heater]

2. <<Client Subsystem>>: SHS Client
3. << Service Subsystem>>:

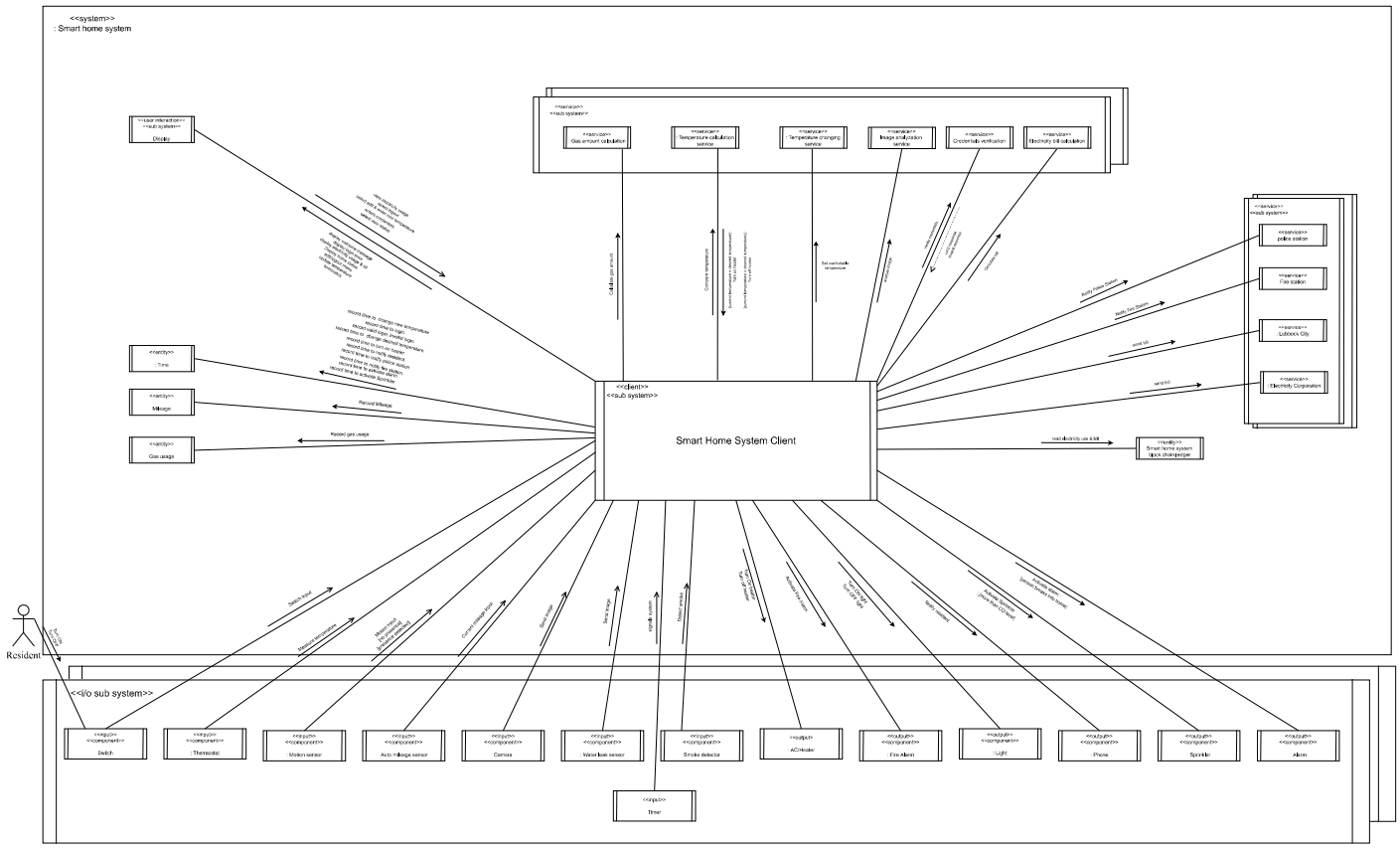
[contains external systems police station, fire station, Lubbock city and Electricity Corporation]

4. <<User Interaction subsystem>>: Keypad display

5. <<service subsystem>>:

[contains SHS service objects like Gas Amount Calculation Service, Temperature Calculation service, Temperature changing service, Image analyzation service, credentials verification service, electricity bill calculation service]

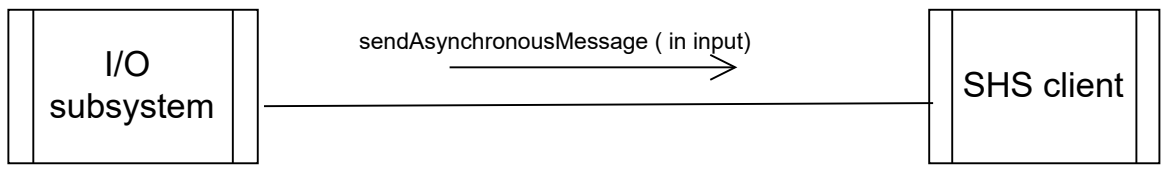
Sub System architecture showing sub systems



Message communication between subsystems

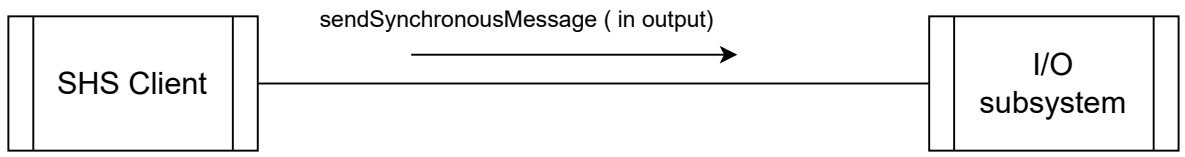
Asynchronous message communication between input subssytem and SHS client subsystem

1)



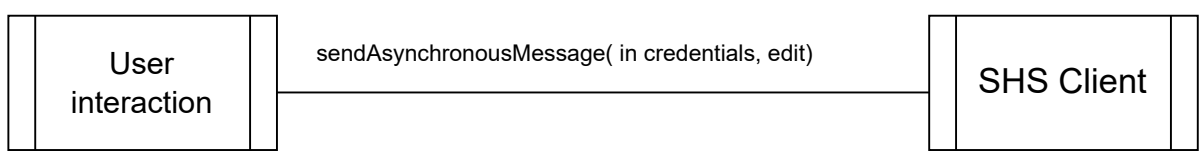
Synchronous message communication between SHS client subsystem and I/O subsystem

2)



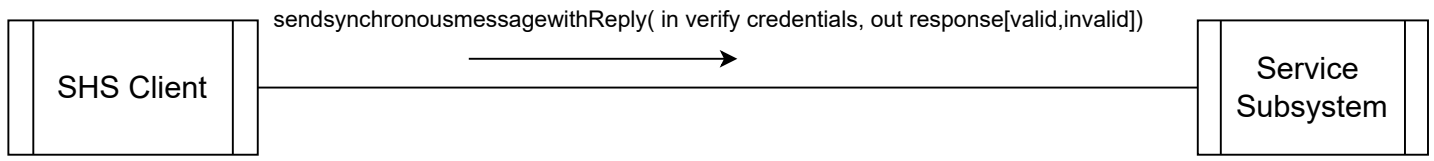
Asynchronous message communication between User interaction and SHS client subsystem

3)



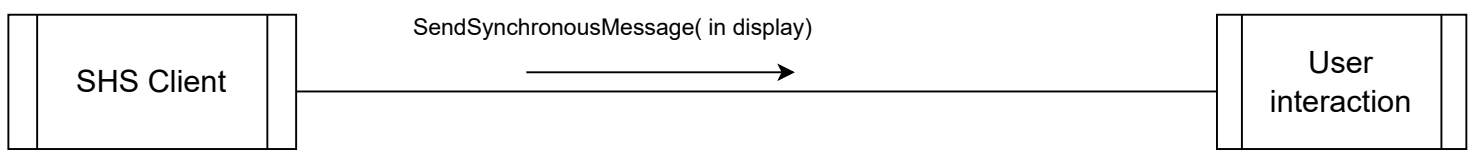
Synchronous message communication with reply between SHS client and Service subsystem(credentials verification service)

4)



Synchronous message communication between SHS Client and User Interaction subsystem

5)

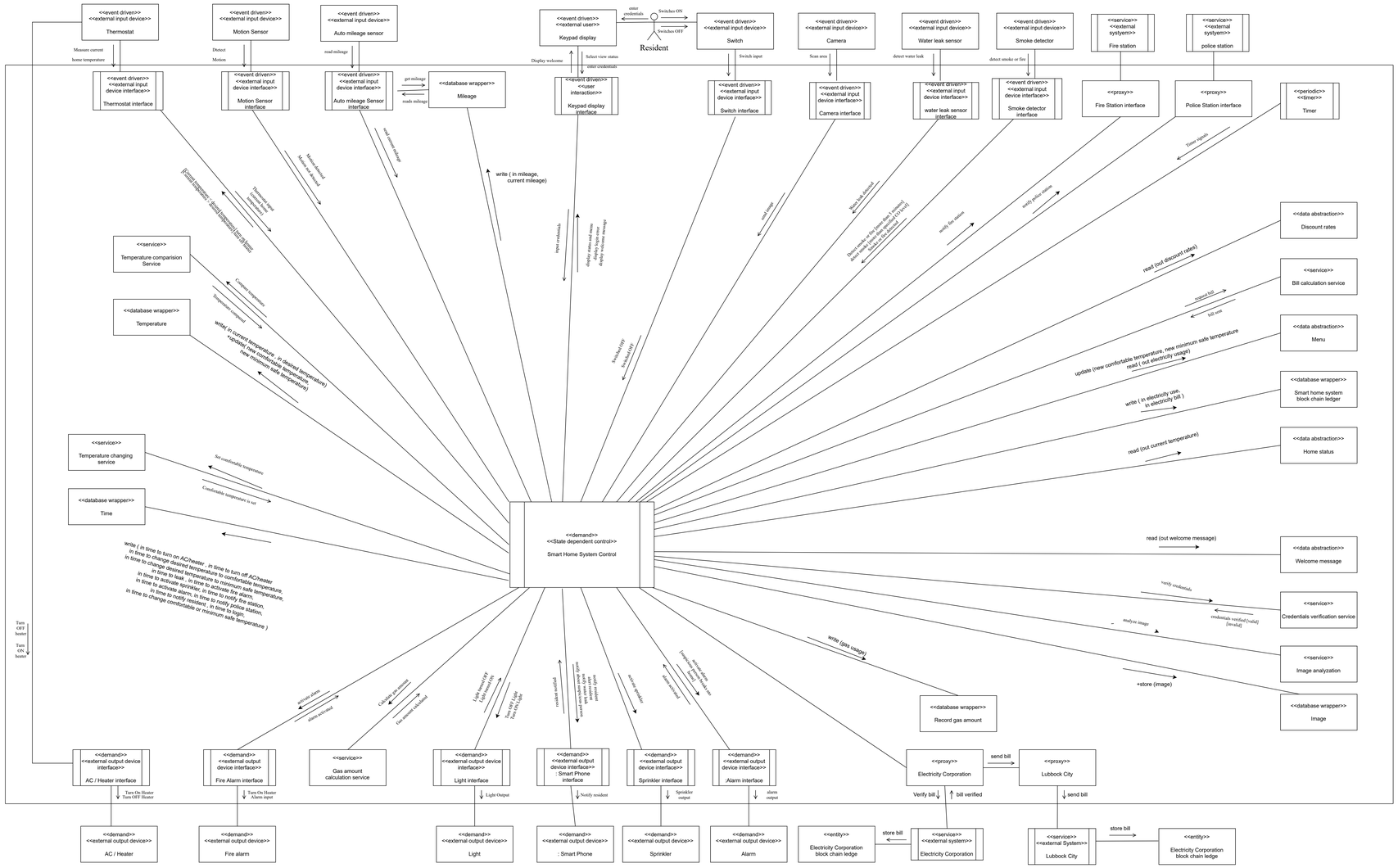


C) Task Architecture

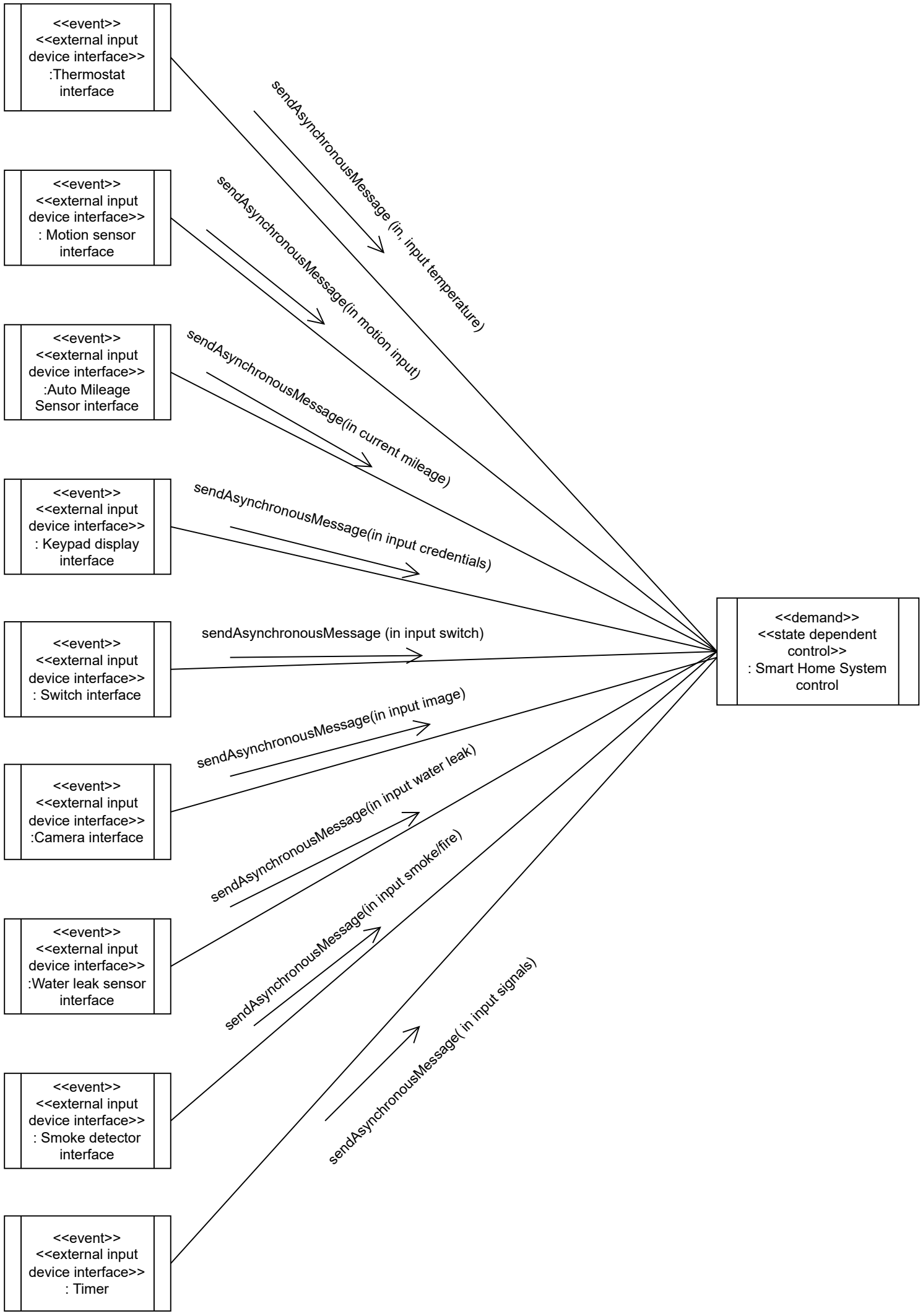
Task structuring criteria :

1) Thermostat interface - Event driven task
2) Motion Sensor interface - Event driven task
3) Auto mileage Sensor interface - Event driven task
4) Keypad display interface - Event driven task
5) Switch interface - Event driven task
6) Camera interface - Event driven task
7) water leak sensor interface - Event driven task
8) Smoke detector interface - Event driven task
9) Timer - Periodic task
10) AC / Heater interface - Demand driven task
11) Fire Alarm interface - Demand driven task
12) Light interface - Demand driven task
13) Phone interface - Demand driven task
14) Sprinkler interface - Demand driven task
15) Alarm interface - Demand driven task

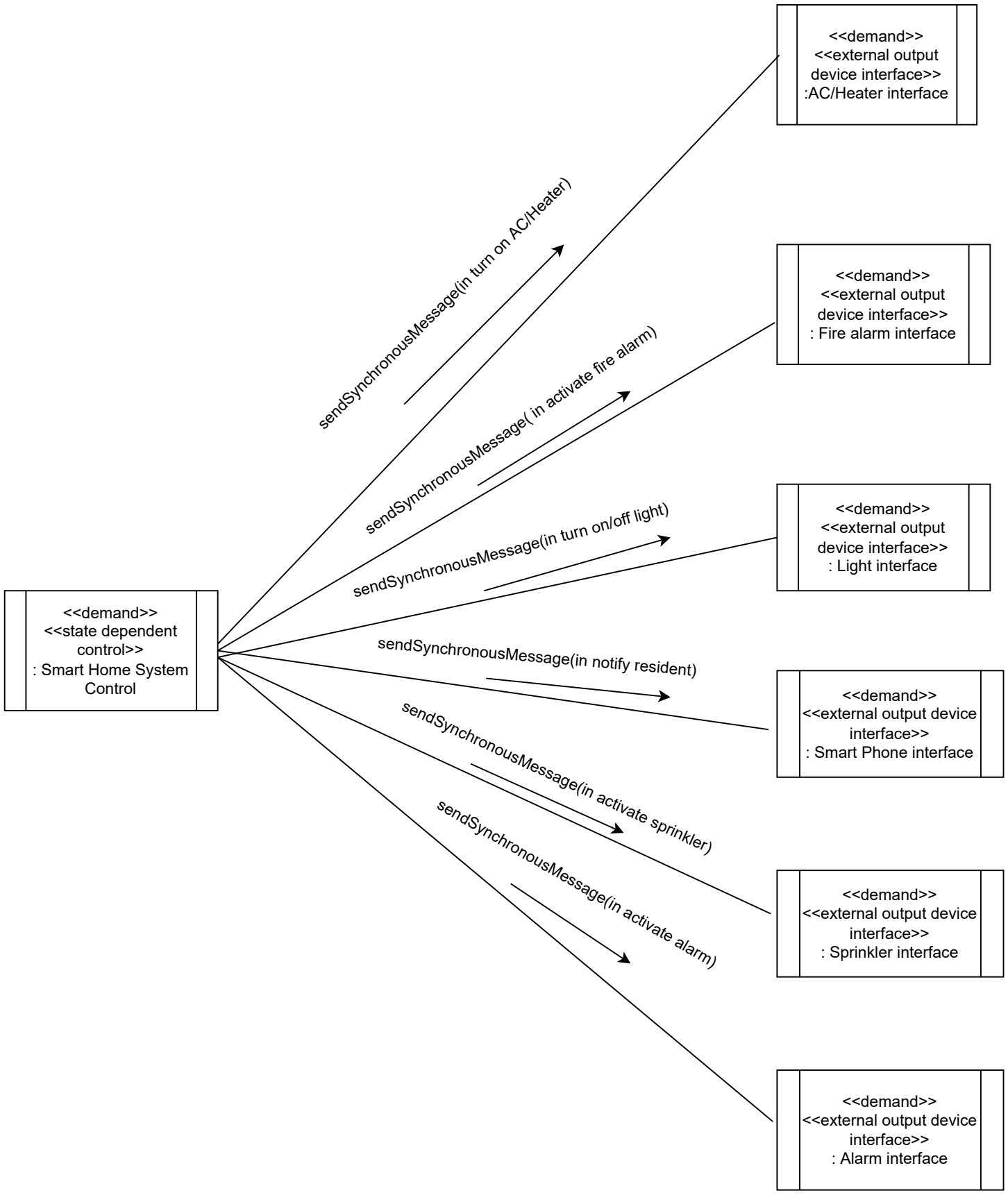
Task architecture of Smart Home System



Asynchronous Message Communication between Tasks



Synchronous Message Communication between tasks



D) Information Hiding Classes

Data abstraction classes:

All the entity classes encapsulate their own data and not requiring any database are data abstraction classes. They are:

welcome message

error message

home status

menu

period

discount rates

water leak alert

Database wrapper classes:

All the entity classes which are not actually encapsulating any data but rather encapsulating the interface to the relational database and are database wrapper classes. They are:

time

temperature

mileage

gas amount

place to leak

CO level

valid login

invalid login

image

smart home blockchain ledger

electricity corporation blockchain ledger

Lubbock city blockchain ledger

Fig - Design of information hiding classes