**EGRBAC AND AEGRBAC POLICIES FOR A SMART BUILDING.**

The purpose of this use case is to provide a representation of a smart building environment in which users are granted access to specific device roles or subsets of device functionality.

In a smart building context, this scenario illustrates how access control and customization of device functions can improve user experience or security.

In a typical smart building, various devices such as climate control systems, lighting, security cameras, and access control systems are interconnected through a central management platform.

Users, based on their roles and permissions, can access and control these devices to create a tailored environment that meets their specific needs and responsibilities.

This use case exemplifies how the versatility of a smart building enables personalized and secure control over device functionality, providing a more comfortable and efficient environment for occupants while maintaining robust security measures.

Specifically, 2 smart buildings consisting of 6 floors, 2 of which are underground and 4 above ground, were designed.

**ROLES BY PLAN**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 3RD FLOOR \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**Chief Technology Officer:** plays a fundamental role in managing environmental sensors such as those used in HVAC (Heating, Ventilation, and Air Conditioning) and Building Management Systems (BMS).

He works alongside the CEO in room 5.

**Chief Executive Officer:** is the top executive of a smart building and plays a crucial role in setting corporate strategy and managing the organization.

He works in his own administrative office, located on the third floor in room 5.

He supervises the work of subordinate offices.

He is the super user, the system administrator and has access to all common devices, security, work and so on.

**Responsible for Physical Security:** anyone working on behalf of the company in the security planning office, located on the third floor in Room 6.

He/she is the one who oversees the physical security of the building, includes controlled access, surveillance and integration with IT systems, providing digital access to various advanced devices (e.g., biometric ports)

Has access to working devices, advanced devices (kitchen, cleaning).

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 2ND FLOOR \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**Manager security informatics-electronics:** anyone working on behalf of the company in the management office, located on the 3rd floor in room 4. He is the one who supervises and manages the engineering office located on the 2nd floor.

He/she has access to the working devices, wifi, in order to properly operate the devices.

**Network computer engineer:** anyone working on behalf of the company in the design office, located on the second floor in Room 3.

He or she has access to common, working devices and is anyone who designs, implements and manages the communication network within the building, ensuring that all devices are connected and operating smoothly.

**Electronic and Software IoT engineer:** Anyone working on behalf of the company in the design office, located on the second floor in room 3.

Has access to basic devices (tablets, PCs, lights...) and anyone who collaborates on the design and installation of the building's electrical and electronic systems, including power systems and connected devices; develops and manages the software that powers the IoT devices in the building, ensuring that they operate effectively and safely.

**Information technician:** anyone who works on behalf of the company in the design office, located on the second floor in room 3.

Has access to basic devices (tablets, PCs, lights...) and anyone provides technical assistance to users and solves any technical problems that may occur with devices or systems in the building.

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 1ST FLOOR \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**Manager human resources accountability:** anyone who works on behalf of the company in the management office, located on the third floor in room 2. He is the one who supervises and manages the human resources and accounting office located on the 1st floor.

He has access to basic devices (tablet, pc, lights ...) and a Smart safe.

**Administrative employees:** anyone who works on behalf of the company in the corporate accounting and administration office, located on the second floor in Room 1.

It is the one who performs accounting and administrative functions related to hired and company personnel.

He/she has access to basic devices (tablets, PCs, lights ...) and a Smart safe.

**Vigilant:** external staff working on behalf of the company, placed at the exterior and interior entrance to the building and on the 1st floor in the video surveillance and server room.

He is a professional who plays a key role in the security and surveillance of the building.

He has access to basic devices (tablets, PCs, lights...) and advanced devices (video surveillance, biometric doors, fire systems, ventilation and various sensors).

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* GROUND FLOOR \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**Receptionist:** anyone who works on behalf of the company, at the entrance located on the ground floor.

He/she is the one who is responsible for welcoming visitors, occupants and making phone calls, providing assistance, information and directing visitors.

Has access to basic devices (tablet, pc, lights, smartphones...).

**Waiter:** anyone who works on behalf of the company, within the dining hall located on the ground floor.

It is the one who is in charge of serving food in the hall and the one who follows the chef's directives on the preparation and presentation of food in the facility.

He has access to basic devices (tablets, lights...) and advanced devices (smart food elevator...).

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* FLOOR -1 \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**Personal trainer:** anyone who works on behalf of the company, within the gym located on the -1 floor.

He/she is the one who is responsible for designing and guiding personalized workout programs for employees, helping them achieve their fitness and health goals.

(pc, tablet, lights, wifi, shower, hair dryer) and advanced devices (smart cardio machines, sports watch...)

**gym client:** the employee who uses the gym service, has access to basic devices (tablets, lights, wifi, shower, hair dryer) and advanced devices (smart cardio machines, sports watch...)

**Chef:** anyone who works on behalf of the company, within the kitchen located on floor -1.

He is the one who is in charge of food preparation and presentation in the facility.

He has access to basic devices (interactive recipe screens, lights, smartphones...) and advanced devices (smart cooktop, smart oven, smart refrigerator...).

**Guest:** can be a customer, visitor, or external collaborator to whom you want to give limited access to smart building devices.

Has access to basic devices (lights, wifi...)

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Mobile staff \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**Cleaner:** anyone who works on behalf of the company in the cleaning sector.

Has access to basic devices (lights, wifi...) and advanced devices (robot cleaners...)

**Legend of roles:**

The following legend shows the acronyms that will be used in the policy.

**CTO 🡪** Chief Technology Officer

**CEO 🡪** Chief Executive Officer

**RPS** 🡪 Responsible for Physical Security

**ITE\_Manager**🡪 Manager security informatics-electronics

**NC\_Engineer** 🡪 Network computer engineer

**ES\_Engineer** 🡪 Electronic and Software IoT engineer

**IT** 🡪 Information technician

**HR\_Manager** 🡪 Manager human resources accountability

**Adm\_empl** 🡪 Administrative employees

**Vigilant 🡪** Vigilant

**Receptionist 🡪** Receptionist

**Waiter 🡪** Waiter

**PT** 🡪 Personal trainer

**Gym\_client 🡪** gym client

**Chef 🡪** chef

**Guest 🡪** Guest

**Cleaner** 🡪 cleaner

**EGRBAC policy**

Users (U), Roles (R) are well-known sets in RBAC systems. A user is a person who is authorized to interact with smart buinding devices. In context of smart buildings, a role includes CEO, responsible for physical security, administrative employee, vigilants and such. UA is a many-to-many relation that assigns users to roles.

**U** = {u1,u2,u3,u4,u5,u6,u7,u8,u9,u10,u11,u12,u13,u14,u15,u16,u17,u18,u19,u20,u21,u22,u23,u24,u25,u26,u27,u28,u29,u30,u31,u32,u33,u34,u35,u36,u37,u38,u39,u40,u41,u42,u43,u44,u45,u46,u47,u48,u4,u50,u51,u52,u53,u54,u55,u56,u57,u58,u59,u60,u61,u62,u63,u64,u65,u66,u67,u68,u69,u70,u71,u72,u73,u74,u75,u76,u77,u78,u79,u80,u81,u82,u83,u84,u85,u86,u87,u88,u89,u90,u91,u92,u93,u94,u95,u96,u97,u98,u99,u100,u101,u102,u103,u104,u105,u106,u107,u108,u109,u110,u111,u112,u113,u114,u115,u116,u117,u118,u119,u120,u121,u122,u123,u124,u125,u126,u127,u128,u129,u130,u131,u132,u133,u134,u135,u136,u137,u138,u139,u140,u141,u142,u143,u144,u145,u146,u147,u148,u149,u150,u151,u152,u153,u154,u155,u156,u157,u158,u159,u160,u161,u162,u163,u164,u165,u166,u167,u168,u169,u170,u171,u172,u173,u174,u175,u176,u177,u178,u179,u180,u181,u182,u183,u184,u185,u186,u187,u188,u189,u190,u191,u192,u193,u194,u195,u196,u197,u198,u199,u200,u201,u202,u203}

**R** = {CTO, CEO\_1, CEO\_2, RPS\_1, RPS\_2, ITE\_Manager\_1, ITE\_Manager\_2, NC\_Engineer\_1, NC\_Engineer\_2, ES\_Engineer\_1, ES\_Engineer\_2, IT\_1, IT\_2, HR\_Manager\_1, HR\_Manager\_2, Adm\_empl\_1, Adm\_empl\_2, Vigilant\_1, Vigilant\_2, Receptionist\_1, Receptionist\_2, Waiter\_1, Waiter\_2, PT\_1, PT\_2, Gym\_client\_1, Gym\_client\_2, Chef\_1, Chef\_2, Guest\_1, Guest\_2, Cleaner\_1, Cleaner\_2}

**UA** = {

(u1,CEO\_1),(u2,RPS\_1),(u3,ITE\_Manager\_1),(u4,NC\_Engineer\_1),(u5,NC\_Engineer\_1),(u6,NC\_Engineer\_1),(u7,ES\_Engineer\_1),(u8,ES\_Engineer\_1),(u9,ES\_Engineer\_1),(u10,IT\_1),(u11,IT\_1),(u12,IT\_1),(u13,HR\_Manager\_1),(u14,Adm\_empl\_1),(u15,Adm\_empl\_1),(u16,Adm\_empl\_1),(u17,Adm\_empl\_1),(u18,Adm\_empl\_1),(u19,Adm\_empl\_1),(u20,Adm\_empl\_1),(u21,Adm\_empl\_1),(u22,Adm\_empl\_1),(u23,Adm\_empl\_1),(u24,Adm\_empl\_1),(u25,Adm\_empl\_1),(u26,Adm\_empl\_1),(u27,Adm\_empl\_1),(u28,Adm\_empl\_1),(u29,Adm\_empl\_1),(u30,Adm\_empl\_1),(u31,Adm\_empl\_1),(u32,Adm\_empl\_1),(u33,Adm\_empl\_1),(u34,Adm\_empl\_1),(u35,Adm\_empl\_1),(u36,Adm\_empl\_1),(u37,Adm\_empl\_1),(u38,Adm\_empl\_1),(u39,Adm\_empl\_1),(u40,Adm\_empl\_1),(u41,Adm\_empl\_1),(u42,Adm\_empl\_1),(u43,Adm\_empl\_1),(u44,Adm\_empl\_1),(u45,Adm\_empl\_1),(u46,Adm\_empl\_1),(u47,Adm\_empl\_1),(u48,Adm\_empl\_1),(u49,Adm\_empl\_1),(u50,Adm\_empl\_1),(u51,Adm\_empl\_1),(u52,Adm\_empl\_1),(u53,Adm\_empl\_1),(u54,Adm\_empl\_1),(u55,Adm\_empl\_1),(u56,Adm\_empl\_1),(u57,Adm\_empl\_1),(u58,Adm\_empl\_1),(u59,Adm\_empl\_1),(u60,Vigilant\_1),(u61,Vigilant\_1),(u62,Vigilant\_1),(u63,Vigilant\_1),(u64,Vigilant\_1),(u65,Vigilant\_1),(u66,Vigilant\_1),(u67,Receptionist\_1),(u68,Receptionist\_1),(u69,Waiter\_1),(u70,Waiter\_1),(u71,Waiter\_1),(u72,Waiter\_1),(u73,Waiter\_1),(u74,PT\_1),(u75,Gym\_client\_1),(u76,Gym\_client\_1),(u77,Gym\_client\_1),(u78,Gym\_client\_1),(u79,Gym\_client\_1),(u80,Gym\_client\_1),(u81,Gym\_client\_1),(u82,Gym\_client\_1),(u83,Chef\_1),(u84,Guest\_1),(u85,Guest\_1),(u86,Guest\_1),(u87,Guest\_1),(u88,Guest\_1),(u89,Guest\_1),(u90,Guest\_1),(u91,Guest\_1),(u92,Guest\_1),(u93,Guest\_1),(u94,Cleaner\_1),(u95,Cleaner\_1),(u96,Cleaner\_1),(u97,Cleaner\_1),(u98,Cleaner\_1),(u99,Cleaner\_1),(u100,Cleaner\_1),(u101,Cleaner\_1),(u102,CEO\_2),(u103,RPS\_2),(u104,ITE\_Manager\_2),(u105,NC\_Engineer\_2),(u106,NC\_Engineer\_2),(u107,NC\_Engineer\_2),(u108,ES\_Engineer\_2),(u109,ES\_Engineer\_2),(u110,ES\_Engineer\_2),(u111,IT\_2),(u112,IT\_2),(u113,IT\_2),(u114,HR\_Manager\_2),(u115,Adm\_empl\_2),(u116,Adm\_empl\_2),(u117,Adm\_empl\_2),(u118,Adm\_empl\_2),(u119,Adm\_empl\_2),(u120,Adm\_empl\_2),(u121,Adm\_empl\_2),(u122,Adm\_empl\_2),(u123,Adm\_empl\_2),(u124,Adm\_empl\_2),(u125,Adm\_empl\_2),(u126,Adm\_empl\_2),(u127,Adm\_empl\_2),(u128,Adm\_empl\_2),(u129,Adm\_empl\_2),(u130,Adm\_empl\_2),(u131,Adm\_empl\_2),(u132,Adm\_empl\_2),(u133,Adm\_empl\_2),(u134,Adm\_empl\_2),(u135,Adm\_empl\_2),(u136,Adm\_empl\_2),(u137,Adm\_empl\_2),(u138,Adm\_empl\_2),(u139,Adm\_empl\_2),(u140,Adm\_empl\_2),(u141,Adm\_empl\_2),(u142,Adm\_empl\_2),(u143,Adm\_empl\_2),(u144,Adm\_empl\_2),(u145,Adm\_empl\_2),(u146,Adm\_empl\_2),(u147,Adm\_empl\_2),(u148,Adm\_empl\_2),(u149,Adm\_empl\_2),(u150,Adm\_empl\_2),(u151,Adm\_empl\_2),(u152,Adm\_empl\_2),(u153,Adm\_empl\_2),(u154,Adm\_empl\_2),(u155,Adm\_empl\_2),(u156,Adm\_empl\_2),(u157,Adm\_empl\_2),(u158,Adm\_empl\_2),(u159,Adm\_empl\_2),(u160,Adm\_empl\_2),(u161,Vigilant\_2),(u162,Vigilant\_2),(u163,Vigilant\_2),(u164,Vigilant\_2),(u165,Vigilant\_2),(u166,Vigilant\_2),(u167,Vigilant\_2),(u168,Receptionist\_2),(u169,Receptionist\_2),(u170,Waiter\_2),(u171,Waiter\_2),(u172,Waiter\_2),(u173,Waiter\_2),(u174,Waiter\_2),(u175,PT\_2),(u176,Gym\_client\_2),(u177,Gym\_client\_2),(u178,Gym\_client\_2),(u179,Gym\_client\_2),(u180,Gym\_client\_2),(u181,Gym\_client\_2),(u182,Gym\_client\_2),(u183,Gym\_client\_2),(u184,Chef\_2),(u185,Guest\_2),(u186,Guest\_2),(u187,Guest\_2),(u188,Guest\_2),(u189,Guest\_2),(u190,Guest\_2),(u191,Guest\_2),(u192,Guest\_2),(u193,Guest\_2),(u194,Guest\_2),(u195,Cleaner\_2),(u196,Cleaner\_2),(u197,Cleaner\_2),(u198,Cleaner\_2),(u199,Cleaner\_2),(u200,Cleaner\_2),(u201,Cleaner\_2),(u202,Cleaner\_2), (u203,CTO)}

Smart building devices like a smart safe are considered devices (D).

Operations (OP) are actions performed on devices in accordance with manufacturer specifications.

A permission is a device, operation pair that allows you to perform an operation on one device.

The set of permissions P is a subset of D×OP.

**D** = {

**TEMPERATURE\_SENSOR**

The first 6 temperature sensors represent temperature sensors ranging from room 1 to room 6 in the first building.

The next 6 temperature sensors represent the temperature sensors ranging from room 7 to room 12 in the second building.

In addition, there are also temperature sensors in the other rooms (denoted by \_1 and \_2 respectively for the two buildings) of the buildings, such as the temperature sensor in the video surveillance room, gymnasium, and so on.

**First building**

TemperatureSensor\_01, TemperatureSensor\_02, TemperatureSensor\_03, TemperatureSensor\_04, TemperatureSensor\_05, TemperatureSensor\_06,

TemperatureSensor\_videosurveillanceroom\_1,TemperatureSensor\_gym\_1,TemperatureSensor\_kitchen\_1,TemperatureSensor\_receptionist\_1,TemperatureSensor\_canteen,\_1,TemperatureSensor\_bath\_1

**Second building**

TemperatureSensor\_07, TemperatureSensor\_08, TemperatureSensor\_09, TemperatureSensor\_10, TemperatureSensor\_11, TemperatureSensor\_12, TemperatureSensor\_videosurveillanceroom\_2,TemperatureSensor\_gym\_2,TemperatureSensor\_kitchen\_2,TemperatureSensor\_receptionist\_2,TemperatureSensor\_canteen,\_2,TemperatureSensor\_bath\_2

**HUMIDITY\_SENSOR**

The first 6 humidity sensors represent humidity sensors ranging from room 1 to room 6 in the first building.

The next 6 humidity sensors represent the humidity sensors ranging from room 7 to room 12 in the second building.

In addition, there are also humidity sensors in the other rooms (denoted by \_1 and \_2 respectively for the two buildings) of the buildings, such as the humidity sensor in the video surveillance room, gymnasium, and so on.

**First building**

HumiditySensor\_01,HumiditySensor\_02,HumiditySensor\_03, HumiditySensor\_04, HumiditySensor\_05, HumiditySensor\_06, HumiditySensor\_videosurveillanceroom\_1,HumiditySensor\_gym\_1,HumiditySensor\_kitchen\_1,HumiditySensor\_receptionist\_1,HumiditySensor\_canteen,\_1,HumiditySensor\_bath\_1

**Second building**

HumiditySensor\_07,HumiditySensor\_08,HumiditySensor\_09, HumiditySensor\_10, HumiditySensor\_11, HumiditySensor\_12, HumiditySensor\_videosurveillanceroom\_2,HumiditySensor\_gym\_2,HumiditySensor\_kitchen\_2,HumiditySensor\_receptionist\_2,HumiditySensor\_canteen,\_2,HumiditySensor\_bath\_2

**OCCUPANCY\_SENSOR**

The first 6 occupancy sensors represent occupancy sensors ranging from room 1 to room 6 in the first building.

The next 6 occupancy sensors represent the occupancy sensors ranging from room 7 to room 12 in the second building.

In addition, there are also occupancy sensors in the other rooms (denoted by \_1 and \_2 respectively for the two buildings) of the buildings, such as the occupancy sensor in the video surveillance room, gymnasium, and so on.

**First building**

OccupancySensor\_01,OccupancySensor\_02,OccupancySensor\_03, OccupancySensor\_04, OccupancySensor\_05, OccupancySensor\_06, OccupancySensor\_videosurveillanceroom\_1,OccupancySensor\_gym\_1,OccupancySensor\_kitchen\_1,OccupancySensor\_receptionist\_1,OccupancySensor\_canteen,\_1,OccupancySensor\_bath\_1

**Second building**

OccupancySensor\_07,OccupancySensor\_08,OccupancySensor\_09, OccupancySensor\_10, OccupancySensor\_11, OccupancySensor\_12, OccupancySensor\_videosurveillanceroom\_2,OccupancySensor\_gym\_2,OccupancySensor\_kitchen\_2,OccupancySensor\_receptionist\_2,OccupancySensor\_canteen,\_2,OccupancySensor\_bath\_2

**LIGHT\_SENSOR**

The first 6 light sensors represent light sensors ranging from room 1 to room 6 in the first building.

The next 6 light sensors represent the light sensors ranging from room 7 to room 12 in the second building.

In addition, there are also light sensors in the other rooms (denoted by \_1 and \_2 respectively for the two buildings) of the buildings, such as the light sensor in the video surveillance room, gymnasium, and so on.

**First building**

LightSensor\_01,LightSensor\_02,LightSensor\_03, LightSensor\_04, LightSensor\_05, LightSensor\_06, LightSensor\_videosurveillanceroom\_1,LightSensor\_gym\_1,LightSensor\_kitchen\_1,LightSensor\_receptionist\_1,LightSensor\_canteen,\_1,LightSensor\_bath\_1

**Second building**

LightSensor\_07,LightSensor\_08,LightSensor\_09, LightSensor\_10, LightSensor\_11, LightSensor\_12, LightSensor\_videosurveillanceroom\_2,LightSensor\_gym\_2,LightSensor\_kitchen\_2,LightSensor\_receptionist\_2,LightSensor\_canteen,\_2,LightSensor\_bath\_2

**HMI (Human machine interface)**

The first 6 HMI represent HMI ranging from room 1 to room 6 in the first building.

The next 6 HMI represent the HMI ranging from room 7 to room 12 in the second building.

In addition, there are also HMI in the other rooms (denoted by \_1 and \_2 respectively for the two buildings) of the buildings, such as the light sensor in the video surveillance room, gymnasium, and so on.

**First building**

HMI\_01,HMI\_02,HMI\_03, HMI\_04, HMI\_05, HMI\_06, HMI\_videosurveillanceroom\_1,HMI\_gym\_1,HMI\_kitchen\_1,HMI\_receptionist\_1,HMI\_canteen,\_1,HMI\_bath\_1

**Second building**

HMI\_07,HMI\_08,HMI\_09, HMI\_10, HMI\_11, HMI\_12, HMI\_videosurveillanceroom\_2,HMI\_gym\_2,HMI\_kitchen\_2,HMI\_receptionist\_2,HMI\_canteen,\_2,HMI\_bath\_2

**PMD (Power management devices)**

The first 6 PMD represent PMD ranging from room 1 to room 6 in the first building.

The next 6 PMD represent the PMD ranging from room 7 to room 12 in the second building.

In addition, there are also PMD in the other rooms (denoted by \_1 and \_2 respectively for the two buildings) of the buildings, such as the light sensor in the video surveillance room, gymnasium, and so on.

**First building**

PMD\_01,PMD\_02,PMD\_03, PMD\_04, PMD\_05, PMD\_06, PMD\_videosurveillanceroom\_1,PMD\_gym\_1,PMD\_kitchen\_1,PMD\_receptionist\_1,PMD\_canteen,\_1,PMD\_bath\_1

**Second building**

PMD\_07,PMD\_08,PMD\_09, PMD\_10, PMD\_11, PMD\_12, PMD\_videosurveillanceroom\_2,PMD\_gym\_2,PMD\_kitchen\_2,PMD\_receptionist\_2,PMD\_canteen,\_2,PMD\_bath\_2

**SMART HEAT PUMP**

Smart heat pumps are put in room 6 for the first smart building and in room 12 in the second smart building.

**First building**

SmartHeatPump\_06

**Secondo building**

SmartHeatPump\_12

**HVAC\_CONTROLLERS**

Hvac controllers pumps are put in server\_1 room for the first smart building and server\_2 room in the second smart building.

**First building**

HvacControllers\_serverRoom\_1

**Secondo building**

HvacControllers\_serverRoom\_2

**SMART\_AIR\_PURIFIER**

Smart air purifier are put in room 6 for the first smart building and in room 12 in the second smart building.

**First building**

SmartAirPurifier\_06

**Secondo building**

SmartAirPurifier\_12

**DOORS**

The first 6 doors represent the doors going from room 1 to room 6 of the first building.

The next 6 doors represent the doors from room 7 to room 12 of the second building.

In addition, there are also the doors to the other rooms (indicated with

\_1 and \_2 respectively representing the two buildings) of the buildings,

such as the video surveillance door, the garage door and so on.

**First building**

DoorLock\_01,DoorLock\_02,DoorLock\_03,DoorLock\_04,DoorLock\_05,DoorLock\_06,

DoorLock\_videosurveillanceroom\_1,DoorLock\_gym\_1,DoorLock\_park\_1,DoorLock\_kitchen\_1,DoorLock\_receptionist\_1,DoorLock\_canteen\_1,DoorLock\_bath\_1,

**Second building**

DoorLock\_07,DoorLock\_08,DoorLock\_09,DoorLock\_10,DoorLock\_11,DoorLock\_12,

DoorLock\_videosurveillanceroom\_2,DoorLock\_gym\_2,DoorLock\_park\_2,DoorLock\_kitchen\_2,DoorLock\_receptionist\_2,DoorLock\_canteen\_2,DoorLock\_bath\_2,

**LIGHTS**

The first 6 lights represent the lights going from room 1 to room 6 in the first building.

The next 6 lights represent the lights going from room 7 to room 12 in the second building.

In addition, there are also the lights of the other rooms (denoted by

\_1 and \_2 respectively for the two buildings) of the buildings,

such as the light in the video surveillance room, the light in the garage, and so on.

**First building**

Lights\_01,Lights\_02,Lights\_03,Lights\_04,Lights\_05,Lights\_06,

Lights\_videosurveillanceroom\_1,Lights\_gym\_1,Lights\_park\_1,Lights\_kitchen\_1,Lights\_receptionist\_1,Lights\_canteen\_1,Lights\_bath\_1

**Second building**

Lights\_07, Lights\_08, Lights\_09, Lights\_10, Lights\_11, Lights\_12,

Lights\_videosurveillanceroom\_2,Lights\_gym\_2,Lights\_park\_2,Lights\_kitchen\_2,Lights\_receptionist\_2,Lights\_canteen\_2,Lights\_bath\_2

**ALEXA**

The first 6 Alexa devices are located from room 1 to room 6 in the first building.

The next 6 Alexa devices are placed from room 7 to room 12 in the second building.

**First building**

Alexa\_01, Alexa\_02, Alexa\_03, Alexa\_04, Alexa\_05, Alexa\_06,

**Second building**

Alexa\_07, Alexa\_08, Alexa\_09, Alexa\_10, Alexa\_11, Alexa\_12

**VIDEO SURVEILLANCE CAMERAS**

Video surveillance cameras have been provided for both buildings inside the parking, gym, kitchen, receptionist, canteen, video surveillance room and in every corridor on the floor.

Each survellanceCameras is denoted by \_1 for the first smart building and \_2 for the second smart building, respectively

**First building**

SurveillanceCameras\_parking\_1,SurveillanceCameras\_gym\_1,SurveillanceCameras\_kitchen\_1,SurveillanceCameras\_receptionist\_1,SurveillanceCameras\_canteen\_1,SurveillanceCameras\_videosurveillanceroom\_1,SurveillanceCameras\_firstfloorcorridor\_1,SurveillanceCameras\_secondfloorcorridor\_1,SurveillanceCameras\_thirdfloorcorridor\_1

**Second building**

SurveillanceCameras\_parking\_2,SurveillanceCameras\_gym\_2,SurveillanceCameras\_kitchen\_2,SurveillanceCameras\_receptionist\_2,SurveillanceCameras\_canteen\_2,SurveillanceCameras\_videosurveillanceroom\_2,SurveillanceCameras\_firstfloorcorridor\_2,SurveillanceCameras\_secondfloorcorridor\_2,SurveillanceCameras\_thirdfloorcorridor\_2,

**THERMOSTATS**

The first 6 thermostats represent the thermostats going in room 1 to room 6 of the first building.

The next 6 thermostats represent the thermostats that go in room 7 up to room 12 in the second building.

In addition, there are also thermostats in the other rooms (indicated by \_1 and \_2 respectively for the two buildings) of the buildings,such as the thermostat in the video surveillance room, gym, and so on.

**First building**

Thermostat\_01, Thermostat\_02, Thermostat\_03, Thermostat\_04,

Thermostat\_05, Thermostat\_06,

Thermostat\_videosurveillanceroom\_1,Thermostat\_gym\_1,Thermostat\_kitchen\_1,Thermostat\_receptionist\_1,Thermostat\_canteen,\_1,Thermostat\_bath\_1

**Second building**

Thermostat\_07, Thermostat\_08, Thermostat\_09, Thermostat\_10,

Thermostat\_11, Thermostat\_12,

Thermostat\_videosurveillanceroom\_2,Thermostat\_gym\_2,Thermostat\_kitchen\_2,Thermostat\_receptionist\_2,Thermostat\_canteen,\_2,Thermostat\_bath\_2

**SMOKE ALARMS**

The first 6 smoke alarms represent the smoke alarms going in room 1 to room 6 of the first building.

The next 6 smoke alarms represent the smoke alarms going into room 7 up to room 12 in the second building.

In addition, there are also the smoke alarms in the other rooms (indicated by \_1 and \_2 respectively for the two buildings) of the buildings, such as the smoke alarm in the video surveillance room, gym, and so on.

**First building**

SmokeAlarm\_01, SmokeAlarm\_02, SmokeAlarm\_03, SmokeAlarm\_04,

SmokeAlarm\_05, SmokeAlarm\_06,

SmokeAlarm\_ videosurveillanceroom\_1,SmokeAlarm\_gym\_1,SmokeAlarm\_park\_1,

SmokeAlarm\_kitchen\_1,SmokeAlarm\_receptionist\_1,SmokeAlarm\_canteen\_1,SmokeAlarm\_bath\_1

**Second building**

SmokeAlarm\_07, SmokeAlarm\_08, SmokeAlarm\_09, SmokeAlarm\_10,

SmokeAlarm\_11, SmokeAlarm\_12,

SmokeAlarm\_ videosurveillanceroom\_2,SmokeAlarm\_gym\_2,SmokeAlarm\_park\_2,

SmokeAlarm\_kitchen\_2,SmokeAlarm\_receptionist\_2,SmokeAlarm\_canteen\_2,SmokeAlarm\_bath\_2

**BURGLAR ALARMS**

The first 6 burglar alarms represent the burglar alarms going in room 1 to room 6 of the first building.

The next 6 burglar alarms represent the burglar alarms going into room 7 up to room 12 in the second building.

In addition, there are also the burglar alarms in the other rooms (indicated by \_1 and \_2 respectively for the two buildings) of the buildings,such as the burglar alarm in the video surveillance room, gym, and so on.

**First building**

BurglarAlarm\_01, BurglarAlarm\_02, BurglarAlarm\_03, BurglarAlarm\_04,

BurglarAlarm\_05, BurglarAlarm\_06,

BurglarAlarm\_videosurveillanceroom\_1,BurglarAlarm\_gym\_1,BurglarAlarm\_park\_1,BurglarAlarm\_kitchen\_1,BurglarAlarm\_receptionist\_1,BurglarAlarm\_canteen\_1,BurglarAlarm\_bath\_1

**Second building**

BurglarAlarm\_07, BurglarAlarm\_08, BurglarAlarm\_09, BurglarAlarm\_10,

BurglarAlarm\_11, BurglarAlarm\_12,

BurglarAlarm\_videosurveillanceroom\_2,BurglarAlarm\_gym\_2,BurglarAlarm\_park\_2,BurglarAlarm\_kitchen\_2,BurglarAlarm\_receptionist\_2,BurglarAlarm\_canteen\_2,BurglarAlarm\_bath\_2

**SAFES**

In this policy it was defined that the safe is present only in rooms 2 and 7, i.e., the rooms of human resources accountability managers.

**First building**

Safe\_room2

**Second building**

Safe\_room7

**MONITORS**

Monitors were established for each building (denoted by \_1 and \_2 respectively) present in the receptionist, gym, kitchen, canteen, and 3 monitors in the video surveillance rooms.

**First building**

Monitor\_receptionist\_1,Monitor\_gym\_1,Monitor\_kitchen\_1,Monitor\_cateen\_1,1Monitor\_ videosurveillance\_1,2Monitor\_ videosurveillance\_1,

3Monitor\_videosurveillance\_1,

**Second building**

Monitor\_receptionist\_2,Monitor\_gym\_2,Monitor\_kitchen\_2,Monitor\_cateen\_2,1Monitor\_ videosurveillance\_2,2Monitor\_ videosurveillance\_2,

3Monitor\_videosurveillance\_2,

**KITCHEN/CANTEEN DEVICES**

Some kitchen/canteen devices have been established including the smart Fridge, DishWasher, IceMaker and so on.

**First building**

Oven\_1,Fridge\_1, DishWasher\_1,SmartCookware&Cooktop\_1,FoodProcessor\_1, IceMaker\_1,SmartCoffeeMachine\_cateen\_1

**Second building**

Oven\_2,Fridge\_2, DishWasher\_2,SmartCookware&Cooktop\_2,FoodProcessor\_2, IceMaker\_2,SmartCoffeeMachine\_cateen\_2

**CLEANING DEVICES**

As with the cunina/canteen devices, smart devices such as the SmartRobotVacuumCleaner and Robotlawnmower were defined for cleaning.

**First building**

SmartRobotVacuumCleaner\_1, Robotlawnmower\_1

**Second building**

SmartRobotVacuumCleaner\_2, Robotlawnmower\_2

**COMPUTERS**

One computer was predetermined for each employee for a total of 68 pcs for the first smart building and the remaining 68 for the second smart building, with a total of 136 pcs.

The only positions not in possession of a pc are the: waiter, gym client, chef, guest, and cleaner.

**First building**

Pc\_01, Pc\_02, Pc\_03, Pc\_04, Pc\_05, Pc\_06, Pc\_07, Pc\_08, Pc\_09, Pc\_10, Pc\_11, Pc\_12, Pc\_13, Pc\_14, Pc\_15, Pc\_16, Pc\_17, Pc\_18, Pc\_19, Pc\_20, Pc\_21, Pc\_22, Pc\_23, Pc\_24, Pc\_25, Pc\_26, Pc\_27, Pc\_28, Pc\_29, Pc\_30, Pc\_31, Pc\_32, Pc\_33, Pc\_34, Pc\_35, Pc\_36, Pc\_37, Pc\_38, Pc\_39, Pc\_40, Pc\_41, Pc\_42, Pc\_43, Pc\_44, Pc\_45, Pc\_46, Pc\_47, Pc\_48, Pc\_49, Pc\_50, Pc\_51, Pc\_52, Pc\_53, Pc\_54, Pc\_55, Pc\_56, Pc\_57, Pc\_58, Pc\_59, Pc\_60, Pc\_61, Pc\_62, Pc\_63, Pc\_64, Pc\_65, Pc\_66, Pc\_67, Pc\_68

**Second building**

Pc\_69, Pc\_70, Pc\_71, Pc\_72, Pc\_73, Pc\_74, Pc\_75, Pc\_76, Pc\_77, Pc\_78, Pc\_79, Pc\_80, Pc\_81, Pc\_82, Pc\_83, Pc\_84, Pc\_85, Pc\_86, Pc\_87, Pc\_88, Pc\_89, Pc\_90, Pc\_91, Pc\_92, Pc\_93, Pc\_94, Pc\_95, Pc\_96, Pc\_97, Pc\_98, Pc\_99, Pc\_100, Pc\_101, Pc\_102, Pc\_103, Pc\_104, Pc\_105, Pc\_106, Pc\_107, Pc\_108, Pc\_109, Pc\_110, Pc\_111, Pc\_112, Pc\_113, Pc\_114, Pc\_115, Pc\_116, Pc\_117, Pc\_118, Pc\_119, Pc\_120, Pc\_121, Pc\_122, Pc\_123, Pc\_124, Pc\_125, Pc\_126, Pc\_127, Pc\_128, Pc\_129, Pc\_130, Pc\_131, Pc\_132, Pc\_133, Pc\_134, Pc\_135, Pc\_136,

Pc\_CTO

**TABLETS**

Tablets have been provided for PT and gym clients.

In addition, the chef and waiters are also provided with tablets.

As in the previous cases, the tablets are labeled with \_1 for the first smart building and \_2 for the second, respectively.

**First building**

Tablet\_PT\_1, Tablet\_client\_gym\_1, Tablet\_kitchen\_1,

1Tablet\_waiter\_1, 2Tablet\_waiter\_1, 3Tablet\_waiter\_1, 4Tablet\_waiter\_1

**Second building**

Tablet\_PT\_2, Tablet\_client\_gym\_2, Tablet\_kitchen\_2,

1Tablet\_waiter\_2, 2Tablet\_waiter\_2, 3Tablet\_waiter\_2, 4Tablet\_waiter\_2

**TAPIRULANS SMART**

Inside the gyms there are smart tapirulans

**First building**

tapirulan\_smart\_1

**Second building**

tapirulan\_smart\_2

**WIFI**

General wifi has been provided for both smart buildings.

**First building**

wifi\_all\_1

**Second building**

wifi\_all\_2

**SMART FAUCETS**

Inside the bathrooms of smart buildings are smart faucets.

**First building**

Smartfaucet\_bath\_1

**Second building**

Smartfaucet\_bath\_2

**GARAGE DOORS**

The different garages have doors

**First building**

GarageDoor\_park\_1

**Second building**

GarageDoor\_park\_2

**ELEVATORS**

Smart buildings are equipped with elevators.

**First building**

Elevator\_1

**Second building**

Elevator\_2

**INTELLIGENT SOLAR SYSTEMS**

Smart buildings are equipped with a intelligent solar system.

**First building**

Intelligent\_solar\_system\_1

**Second building**

Intelligent\_solar\_system\_2

**BIOMETRIC SYSTEMS**

Smart buildings are equipped with a biometric system.

**First building**

Biometric\_system\_1

**Second building**

Biometric\_system\_2

}

**OP** = {

**TEMPERATURE\_SENSOR**

On, Off and Schedule operations have been defined for temperature sensors.

***On***

**First building**

On\_TemperatureSensor\_01, On\_TemperatureSensor\_02, On\_TemperatureSensor\_03, On\_TemperatureSensor\_04, On\_TemperatureSensor\_05, On\_TemperatureSensor\_06,

On\_TemperatureSensor\_videosurveillanceroom\_1,On\_TemperatureSensor\_gym\_1,On\_TemperatureSensor\_kitchen\_1,On\_TemperatureSensor\_receptionist\_1,On\_TemperatureSensor\_canteen,\_1,On\_TemperatureSensor\_bath\_1

**Second building**

On\_TemperatureSensor\_07, On\_TemperatureSensor\_08, On\_TemperatureSensor\_09, On\_TemperatureSensor\_10, On\_TemperatureSensor\_11, On\_TemperatureSensor\_12,

On\_TemperatureSensor\_videosurveillanceroom\_2,On\_TemperatureSensor\_gym\_2,On\_TemperatureSensor\_kitchen\_2,On\_TemperatureSensor\_receptionist\_2,On\_TemperatureSensor\_canteen,\_2,On\_TemperatureSensor\_bath\_2

***Off***

**First building**

Off\_TemperatureSensor\_01,Off\_TemperatureSensor\_02,Off\_TemperatureSensor\_0,Off\_TemperatureSensor\_04, Off\_TemperatureSensor\_05, Off\_TemperatureSensor\_06,Off\_TemperatureSensor\_videosurveillanceroom\_1,Off\_TemperatureSensor\_gym\_1,Off\_TemperatureSensor\_kitchen\_1,Off\_TemperatureSensor\_receptionist\_1,Off\_TemperatureSensor\_canteen,\_1,Off\_TemperatureSensor\_bath\_1

**Second building**

Off\_TemperatureSensor\_07,Off\_TemperatureSensor\_08,Off\_TemperatureSensor\_09,Off\_TemperatureSensor\_10, Off\_TemperatureSensor\_11, Off\_TemperatureSensor\_12,Off\_TemperatureSensor\_videosurveillanceroom\_2,Off\_TemperatureSensor\_gym\_2,Off\_TemperatureSensor\_kitchen\_2,Off\_TemperatureSensor\_receptionist\_2,Off\_TemperatureSensor\_canteen,\_2,Off\_TemperatureSensor\_bath\_2

***Schedule***

**First building**

Schedule\_TemperatureSensor\_01,Schedule\_TemperatureSensor\_02,Schedule\_TemperatureSensor\_03,Schedule\_TemperatureSensor\_04,

Schedule\_TemperatureSensor\_05, Schedule\_TemperatureSensor\_06,

Schedule\_TemperatureSensor\_videosurveillanceroom\_1,Schedule\_TemperatureSensor\_gym\_1,Schedule\_TemperatureSensor\_kitchen\_1,Schedule\_TemperatureSensor\_receptionist\_1,Schedule\_TemperatureSensor\_canteen,\_1,Schedule\_TemperatureSensor\_bath\_1

**Second building**

Schedule\_TemperatureSensor\_07,Schedule\_TemperatureSensor\_08,Schedule\_TemperatureSensor\_09,Schedule\_TemperatureSensor\_10,

Schedule\_TemperatureSensor\_11, Schedule\_TemperatureSensor\_12,

Schedule\_TemperatureSensor\_videosurveillanceroom\_2,Schedule\_TemperatureSensor\_gym\_2,Schedule\_TemperatureSensor\_kitchen\_2,Schedule\_TemperatureSensor\_receptionist\_2,Schedule\_TemperatureSensor\_canteen,\_2,Schedule\_TemperatureSensor\_bath\_2

**HUMIDITY\_SENSOR**

On, Off and Schedule operations have been defined for humidity sensors.

***On***

**First building**

On\_HumiditySensor\_01, On\_HumiditySensor\_02, On\_HumiditySensor\_03, On\_HumiditySensor\_04, On\_HumiditySensor\_05, On\_HumiditySensor\_06,

On\_HumiditySensor\_videosurveillanceroom\_1,On\_HumiditySensor\_gym\_1,On\_HumiditySensor\_kitchen\_1,On\_HumiditySensor\_receptionist\_1,On\_HumiditySensor\_canteen,\_1,On\_HumiditySensor\_bath\_1

**Second building**

On\_HumiditySensor\_07, On\_HumiditySensor\_08, On\_HumiditySensor\_09, On\_HumiditySensor\_10, On\_HumiditySensor\_11, On\_HumiditySensor\_12,

On\_HumiditySensor\_videosurveillanceroom\_2,On\_HumiditySensor\_gym\_2,On\_HumiditySensor\_kitchen\_2,On\_HumiditySensor\_receptionist\_2,On\_HumiditySensor\_canteen,\_2,On\_HumiditySensor\_bath\_2

***Off***

**First building**

Off\_HumiditySensor\_01,Off\_HumiditySensor\_02,Off\_HumiditySensor\_0,Off\_HumiditySensor\_04, Off\_HumiditySensor\_05, Off\_HumiditySensor\_06,Off\_HumiditySensor\_videosurveillanceroom\_1,Off\_HumiditySensor\_gym\_1,Off\_HumiditySensor\_kitchen\_1,Off\_HumiditySensor\_receptionist\_1,Off\_HumiditySensor\_canteen,\_1,Off\_HumiditySensor\_bath\_1

**Second building**

Off\_HumiditySensor\_07,Off\_HumiditySensor\_08,Off\_HumiditySensor\_09,Off\_HumiditySensor\_10, Off\_HumiditySensor\_11, Off\_HumiditySensor\_12,Off\_HumiditySensor\_videosurveillanceroom\_2,Off\_HumiditySensor\_gym\_2,Off\_HumiditySensor\_kitchen\_2,Off\_HumiditySensor\_receptionist\_2,Off\_HumiditySensor\_canteen,\_2,Off\_HumiditySensor\_bath\_2

***Schedule***

**First building**

Schedule\_HumiditySensor\_01,Schedule\_HumiditySensor\_02,Schedule\_HumiditySensor\_03,Schedule\_HumiditySensor\_04,

Schedule\_HumiditySensor\_05, Schedule\_HumiditySensor\_06,

Schedule\_HumiditySensor\_videosurveillanceroom\_1,Schedule\_HumiditySensor\_gym\_1,Schedule\_HumiditySensor\_kitchen\_1,Schedule\_HumiditySensor\_receptionist\_1,Schedule\_HumiditySensor\_canteen,\_1,Schedule\_HumiditySensor\_bath\_1

**Second building**

Schedule\_HumiditySensor\_07,Schedule\_HumiditySensor\_08,Schedule\_HumiditySensor\_09,Schedule\_HumiditySensor\_10,

Schedule\_HumiditySensor\_11, Schedule\_HumiditySensor\_12,

Schedule\_HumiditySensor\_videosurveillanceroom\_2,Schedule\_HumiditySensor\_gym\_2,Schedule\_HumiditySensor\_kitchen\_2,Schedule\_HumiditySensor\_receptionist\_2,Schedule\_HumiditySensor\_canteen,\_2,Schedule\_HumiditySensor\_bath\_2

**OCCUPANCY\_SENSOR**

On, Off and Schedule operations have been defined for occupancy sensors.

***On***

**First building**

On\_OccupancySensor\_01, On\_OccupancySensor\_02, On\_OccupancySensor\_03, On\_OccupancySensor\_04, On\_OccupancySensor\_05, On\_OccupancySensor\_06,

On\_OccupancySensor\_videosurveillanceroom\_1,On\_OccupancySensor\_gym\_1,On\_OccupancySensor\_kitchen\_1,On\_OccupancySensor\_receptionist\_1,On\_OccupancySensor\_canteen,\_1,On\_OccupancySensor\_bath\_1

**Second building**

On\_OccupancySensor\_07, On\_OccupancySensor\_08, On\_OccupancySensor\_09, On\_OccupancySensor\_10, On\_OccupancySensor\_11, On\_OccupancySensor\_12,

On\_OccupancySensor\_videosurveillanceroom\_2,On\_OccupancySensor\_gym\_2,On\_OccupancySensor\_kitchen\_2,On\_OccupancySensor\_receptionist\_2,On\_OccupancySensor\_canteen,\_2,On\_OccupancySensor\_bath\_2

***Off***

**First building**

Off\_OccupancySensor\_01,Off\_OccupancySensor\_02,Off\_OccupancySensor\_0,Off\_OccupancySensor\_04, Off\_OccupancySensor\_05, Off\_OccupancySensor\_06,Off\_OccupancySensor\_videosurveillanceroom\_1,Off\_OccupancySensor\_gym\_1,Off\_OccupancySensor\_kitchen\_1,Off\_OccupancySensor\_receptionist\_1,Off\_OccupancySensor\_canteen,\_1,Off\_OccupancySensor\_bath\_1

**Second building**

Off\_OccupancySensor\_07,Off\_OccupancySensor\_08,Off\_OccupancySensor\_09,Off\_OccupancySensor\_10, Off\_OccupancySensor\_11, Off\_OccupancySensor\_12,Off\_OccupancySensor\_videosurveillanceroom\_2,Off\_OccupancySensor\_gym\_2,Off\_OccupancySensor\_kitchen\_2,Off\_OccupancySensor\_receptionist\_2,Off\_OccupancySensor\_canteen,\_2,Off\_OccupancySensor\_bath\_2

***Schedule***

**First building**

Schedule\_OccupancySensor\_01,Schedule\_OccupancySensor\_02,Schedule\_OccupancySensor\_03,Schedule\_OccupancySensor\_04,

Schedule\_OccupancySensor\_05, Schedule\_OccupancySensor\_06,

Schedule\_OccupancySensor\_videosurveillanceroom\_1,Schedule\_OccupancySensor\_gym\_1,Schedule\_OccupancySensor\_kitchen\_1,Schedule\_OccupancySensor\_receptionist\_1,Schedule\_OccupancySensor\_canteen,\_1,Schedule\_OccupancySensor\_bath\_1

**Second building**

Schedule\_OccupancySensor\_07,Schedule\_OccupancySensor\_08,Schedule\_OccupancySensor\_09,Schedule\_OccupancySensor\_10,

Schedule\_OccupancySensor\_11, Schedule\_OccupancySensor\_12,

Schedule\_OccupancySensor\_videosurveillanceroom\_2,Schedule\_OccupancySensor\_gym\_2,Schedule\_OccupancySensor\_kitchen\_2,Schedule\_OccupancySensor\_receptionist\_2,Schedule\_OccupancySensor\_canteen,\_2,Schedule\_OccupancySensor\_bath\_2

**LIGHT\_SENSOR**

On, Off and Schedule operations have been defined for light sensors.

***On***

**First building**

On\_LightSensor\_01, On\_LightSensor\_02, On\_LightSensor\_03, On\_LightSensor\_04, On\_LightSensor\_05, On\_LightSensor\_06,

On\_LightSensor\_videosurveillanceroom\_1,On\_LightSensor\_gym\_1,On\_LightSensor\_kitchen\_1,On\_LightSensor\_receptionist\_1,On\_LightSensor\_canteen,\_1,On\_LightSensor\_bath\_1

**Second building**

On\_LightSensor\_07, On\_LightSensor\_08, On\_LightSensor\_09, On\_LightSensor\_10, On\_LightSensor\_11, On\_LightSensor\_12,

On\_LightSensor\_videosurveillanceroom\_2,On\_LightSensor\_gym\_2,On\_LightSensor\_kitchen\_2,On\_LightSensor\_receptionist\_2,On\_LightSensor\_canteen,\_2,On\_LightSensor\_bath\_2

***Off***

**First building**

Off\_LightSensor\_01,Off\_LightSensor\_02,Off\_LightSensor\_0,Off\_LightSensor\_04, Off\_LightSensor\_05, Off\_LightSensor\_06,Off\_LightSensor\_videosurveillanceroom\_1,Off\_LightSensor\_gym\_1,Off\_LightSensor\_kitchen\_1,Off\_LightSensor\_receptionist\_1,Off\_LightSensor\_canteen,\_1,Off\_LightSensor\_bath\_1

**Second building**

Off\_LightSensor\_07,Off\_LightSensor\_08,Off\_LightSensor\_09,Off\_LightSensor\_10, Off\_LightSensor\_11, Off\_LightSensor\_12,Off\_LightSensor\_videosurveillanceroom\_2,Off\_LightSensor\_gym\_2,Off\_LightSensor\_kitchen\_2,Off\_LightSensor\_receptionist\_2,Off\_LightSensor\_canteen,\_2,Off\_LightSensor\_bath\_2

***Schedule***

**First building**

Schedule\_LightSensor\_01,Schedule\_LightSensor\_02,Schedule\_LightSensor\_03,Schedule\_LightSensor\_04,

Schedule\_LightSensor\_05, Schedule\_LightSensor\_06,

Schedule\_LightSensor\_videosurveillanceroom\_1,Schedule\_LightSensor\_gym\_1,Schedule\_LightSensor\_kitchen\_1,Schedule\_LightSensor\_receptionist\_1,Schedule\_LightSensor\_canteen,\_1,Schedule\_LightSensor\_bath\_1

**Second building**

Schedule\_LightSensor\_07,Schedule\_LightSensor\_08,Schedule\_LightSensor\_09,Schedule\_LightSensor\_10,

Schedule\_LightSensor\_11, Schedule\_LightSensor\_12,

Schedule\_LightSensor\_videosurveillanceroom\_2,Schedule\_LightSensor\_gym\_2,Schedule\_LightSensor\_kitchen\_2,Schedule\_LightSensor\_receptionist\_2,Schedule\_LightSensor\_canteen,\_2,Schedule\_LightSensor\_bath\_2

**HMI (Human machine interface)**

On, Off, display and status operations have been defined for HMI.

***On***

**First building**

On\_HMI\_01, On\_HMI\_02, On\_HMI\_03, On\_HMI\_04, On\_HMI\_05, On\_HMI\_06,

On\_HMI\_videosurveillanceroom\_1,On\_HMI\_gym\_1,On\_HMI\_kitchen\_1,On\_HMI\_receptionist\_1,On\_HMI\_canteen,\_1,On\_HMI\_bath\_1

**Second building**

On\_HMI\_07, On\_HMI\_08, On\_HMI\_09, On\_HMI\_10, On\_HMI\_11, On\_HMI\_12,

On\_HMI\_videosurveillanceroom\_2,On\_HMI\_gym\_2,On\_HMI\_kitchen\_2,On\_HMI\_receptionist\_2,On\_HMI\_canteen,\_2,On\_HMI\_bath\_2

***Off***

**First building**

Off\_HMI\_01,Off\_HMI\_02,Off\_HMI\_0,Off\_HMI\_04, Off\_HMI\_05, Off\_HMI\_06,Off\_HMI\_videosurveillanceroom\_1,Off\_HMI\_gym\_1,Off\_HMI\_kitchen\_1,Off\_HMI\_receptionist\_1,Off\_HMI\_canteen,\_1,Off\_HMI\_bath\_1

**Second building**

Off\_HMI\_07,Off\_HMI\_08,Off\_HMI\_09,Off\_HMI\_10, Off\_HMI\_11, Off\_HMI\_12,Off\_HMI\_videosurveillanceroom\_2,Off\_HMI\_gym\_2,Off\_HMI\_kitchen\_2,Off\_HMI\_receptionist\_2,Off\_HMI\_canteen,\_2,Off\_HMI\_bath\_2

***Display***

**First building**

Display\_HMI\_01,Display\_HMI\_02,Display\_HMI\_03,Display\_HMI\_04,

Display\_HMI\_05, Display\_HMI\_06,

Display\_HMI\_videosurveillanceroom\_1,Display\_HMI\_gym\_1,Display\_HMI\_kitchen\_1,Display\_HMI\_receptionist\_1,Display\_HMI\_canteen,\_1,Display\_HMI\_bath\_1

**Second building**

Display\_HMI\_07,Display\_HMI\_08,Display\_HMI\_09,Display\_HMI\_10,

Display\_HMI\_11, Display\_HMI\_12,

Display\_HMI\_videosurveillanceroom\_2,Display\_HMI\_gym\_2,Display\_HMI\_kitchen\_2,Display\_HMI\_receptionist\_2,Display\_HMI\_canteen,\_2,Display\_HMI\_bath\_2

**Status**

**First building**

Status\_HMI\_01,Status\_HMI\_02,Status\_HMI\_03,Status\_HMI\_04,

Status\_HMI\_05, Status\_HMI\_06,

Status\_HMI\_videosurveillanceroom\_1,Status\_HMI\_gym\_1,Status\_HMI\_kitchen\_1,Status\_HMI\_receptionist\_1,Status\_HMI\_canteen,\_1,Status\_HMI\_bath\_1

**Second building**

Status\_HMI\_07,Status\_HMI\_08,Status\_HMI\_09,Status\_HMI\_10,

Status\_HMI\_11, Status\_HMI\_12,

Status\_HMI\_videosurveillanceroom\_2,Status\_HMI\_gym\_2,Status\_HMI\_kitchen\_2,Status\_HMI\_receptionist\_2,Status\_HMI\_canteen,\_2,Status\_HMI\_bath\_2

**PMD (Power management devices)**

On, Off, monitor and manage operations have been defined for HMI.

***On***

**First building**

On\_PMD\_01, On\_PMD\_02, On\_PMD\_03, On\_PMD\_04, On\_PMD\_05, On\_PMD\_06,

On\_PMD\_videosurveillanceroom\_1,On\_PMD\_gym\_1,On\_PMD\_kitchen\_1,On\_PMD\_receptionist\_1,On\_PMD\_canteen,\_1,On\_PMD\_bath\_1

**Second building**

On\_PMD\_07, On\_PMD\_08, On\_PMD\_09, On\_PMD\_10, On\_PMD\_11, On\_PMD\_12,

On\_PMD\_videosurveillanceroom\_2,On\_PMD\_gym\_2,On\_PMD\_kitchen\_2,On\_PMD\_receptionist\_2,On\_PMD\_canteen,\_2,On\_PMD\_bath\_2

***Off***

**First building**

Off\_PMD\_01,Off\_PMD\_02,Off\_PMD\_0,Off\_PMD\_04, Off\_PMD\_05, Off\_PMD\_06,Off\_PMD\_videosurveillanceroom\_1,Off\_PMD\_gym\_1,Off\_PMD\_kitchen\_1,Off\_PMD\_receptionist\_1,Off\_PMD\_canteen,\_1,Off\_PMD\_bath\_1

**Second building**

Off\_PMD\_07,Off\_PMD\_08,Off\_PMD\_09,Off\_PMD\_10, Off\_PMD\_11, Off\_PMD\_12,Off\_PMD\_videosurveillanceroom\_2,Off\_PMD\_gym\_2,Off\_PMD\_kitchen\_2,Off\_PMD\_receptionist\_2,Off\_PMD\_canteen,\_2,Off\_PMD\_bath\_2

**Monitor**

**First building**

Monitor\_PMD\_01,Monitor\_PMD\_02,Monitor\_PMD\_0,Monitor\_PMD\_04, Monitor\_PMD\_05, Monitor\_PMD\_06,Monitor\_PMD\_videosurveillanceroom\_1,Monitor\_PMD\_gym\_1,Monitor\_PMD\_kitchen\_1,Monitor\_PMD\_receptionist\_1,Monitor\_PMD\_canteen,\_1,Monitor\_PMD\_bath\_1

**Second building**

Monitor\_PMD\_07,Monitor\_PMD\_08,Monitor\_PMD\_09,Monitor\_PMD\_10, Monitor\_PMD\_11, Monitor\_PMD\_12,Monitor\_PMD\_videosurveillanceroom\_2,Monitor\_PMD\_gym\_2,Monitor\_PMD\_kitchen\_2,Monitor\_PMD\_receptionist\_2,Monitor\_PMD\_canteen,\_2,Monitor\_PMD\_bath\_2

**Manage**

**First building**

Manage\_PMD\_01,Manage\_PMD\_02,Manage\_PMD\_0,Manage\_PMD\_04, Manage\_PMD\_05, Manage\_PMD\_06,Manage\_PMD\_videosurveillanceroom\_1,Manage\_PMD\_gym\_1,Manage\_PMD\_kitchen\_1,Manage\_PMD\_receptionist\_1,Manage\_PMD\_canteen,\_1,Manage\_PMD\_bath\_1

**Second building**

Manage\_PMD\_07,Manage\_PMD\_08,Manage\_PMD\_09,Manage\_PMD\_10, Manage\_PMD\_11, Manage\_PMD\_12,Manage\_PMD\_videosurveillanceroom\_2,Manage\_PMD\_gym\_2,Manage\_PMD\_kitchen\_2,Manage\_PMD\_receptionist\_2,Manage\_PMD\_canteen,\_2,Manage\_PMD\_bath\_2

**SMART HEAT PUMP**

On, Off and display operations have been defined for SMART HEAT PUMP.

**On**

**First building**

On\_SmartHeatPump\_06

**Secondo building**

On\_SmartHeatPump\_12

**Off**

**First building**

Off\_SmartHeatPump\_06

**Secondo building**

Off\_SmartHeatPump\_12

**Display**

**First building**

Display\_SmartHeatPump\_06

**Secondo building**

Display\_SmartHeatPump\_12

**HVAC\_CONTROLLERS**

On, Off and setup operations have been defined for HVAC controllers.

**On**

**First building**

On\_HvacControllers\_serverRoom\_1

**Secondo building**

On\_HvacControllers\_serverRoom\_2

**Off**

**First building**

Off\_HvacControllers\_serverRoom\_1

**Secondo building**

Off\_HvacControllers\_serverRoom\_2

**Setup**

**First building**

Setup\_HvacControllers\_serverRoom\_1

**Secondo building**

Setup\_HvacControllers\_serverRoom\_2

**SMART\_AIR\_PURIFIER**

On, Off and display operations have been defined for Smart air purifier.

**On**

**First building**

On\_SmartAirPurifier\_06

**Secondo building**

On\_SmartAirPurifier\_12

**Off**

**First building**

Off\_SmartAirPurifier\_06

**Secondo building**

Off\_SmartAirPurifier\_12

**Display**

**First building**

Display\_SmartAirPurifier\_06

**Secondo building**

Display\_SmartAirPurifier\_12

**DOORS**

Lock and unlock operations have been defined for the defined doors.

***Lock***

**First building**

Lock\_01, Lock\_02, Lock\_03, Lock\_04, Lock\_05,Lock\_06,

Lock\_videosurveillanceroom\_1,Lock\_gym\_1,Lock\_park\_1,Lock\_kitchen\_1,Lock\_receptionist\_1, Lock\_canteen\_1, Lock\_bath\_1

**Second building**

Lock\_07, Lock\_08, Lock\_09, Lock\_10, Lock\_11, Lock\_12,

Lock\_videosurveillanceroom\_2,Lock\_gym\_2,Lock\_park\_2,Lock\_kitchen\_2,Lock\_receptionist\_2, Lock\_canteen\_2, Lock\_bath\_2,

***Unlock***

**First building**

Unlock\_01, Unlock\_02, Unlock\_03, Unlock\_04, Unlock\_05,Unlock\_06,

Unlock\_videosurveillanceroom\_1,Unlock\_gym\_1,Unlock\_park\_1,Unlock\_kitchen\_1,Unlock\_receptionist\_1, Unlock\_canteen\_1, Unlock\_bath\_1

**Second building**

Unlock\_07, Unlock\_08, Unlock\_09, Unlock\_10, Unlock\_11, Unlock\_12,

Unlock\_videosurveillanceroom\_2,Unlock\_gym\_2,Unlock\_park\_2,Unlock\_kitchen\_2,Unlock\_receptionist\_2, Unlock\_canteen\_2, Unlock\_bath\_2,

**LIGHTS**

On and Off operations have been defined for the defined lights.

***On***

**First building**

On\_Ligths\_01,On\_Ligths\_02,On\_Ligths\_03,On\_Ligths\_04,On\_Ligths\_05,On\_Ligths\_06,

On\_Ligths\_videosurveillanceroom\_1,On\_Ligths\_gym\_1,On\_Ligths\_park\_1,On\_Ligths\_kitchen\_1,On\_Ligths\_receptionist\_1,On\_Ligths\_canteen\_1,On\_Ligths\_bath\_1

**Second building**

On\_Ligths\_07, On\_Ligths\_08, On\_Ligths\_09, On\_Ligths\_10, On\_Ligths\_11, On\_Ligths\_12,

On\_Ligths\_videosurveillanceroom\_2,On\_Ligths\_gym\_2,On\_Ligths\_park\_2,On\_Ligths\_kitchen\_2,On\_Ligths\_receptionist\_2,On\_Ligths\_canteen\_2,On\_Ligths\_bath\_2

***Off***

**First building**

Off\_Ligths\_01,Off\_Ligths\_02,Off\_Ligths\_03,Off\_Ligths\_04,Off\_Ligths\_05,Off\_Ligths\_06,

Off\_Ligths\_videosurveillanceroom\_1,Off\_Ligths\_gym\_1,Off\_Ligths\_park\_1,Off\_Ligths\_kitchen\_1,Off\_Ligths\_receptionist\_1,Off\_Ligths\_canteen\_1,Off\_Ligths\_bath\_1

**Second building**

Off\_Ligths\_07, Off\_Ligths\_08, Off\_Ligths\_09, Off\_Ligths\_10, Off\_Ligths\_11, Off\_Ligths\_12,

Off\_Ligths\_videosurveillanceroom\_2,Off\_Ligths\_gym\_2,Off\_Ligths\_park\_2,Off\_Ligths\_kitchen\_2,Off\_Ligths\_receptionist\_2,Off\_Ligths\_canteen\_2,Off\_Ligths\_bath\_2

**ALEXA**

Activate and Deactivate operations have been defined for Alexa.

***Activate***

**First building**

Activate\_Alexa\_01, Activate\_Alexa\_02, Activate\_Alexa\_03, Activate\_Alexa\_04, Activate\_Alexa\_05, Activate\_Alexa\_06,

**Second building**

Activate\_Alexa\_07, Activate\_Alexa\_08, Activate\_Alexa\_09, Activate\_Alexa\_10, Activate\_Alexa\_11, Activate\_Alexa\_12

***Deactivate***

**First building**

Deactivate\_Alexa\_01, Deactivate\_Alexa\_02, Deactivate\_Alexa\_03, Deactivate\_Alexa\_04, Deactivate\_Alexa\_05, Deactivate\_Alexa\_06,

**Second building**

Deactivate\_Alexa\_07, Deactivate\_Alexa\_08, Deactivate\_Alexa\_09, Deactivate\_Alexa\_10, Deactivate\_Alexa\_11, Deactivate\_Alexa\_12

**VIDEO SURVEILLANCE CAMERAS**

Startrecording and Storprecording operations have been defined for all video surveillance cameras, this is because they are managed by a single role.

***startrecording***

**First building**

startrecording\_SurveillanceCameras\_1

**Second building**

startrecording\_SurveillanceCameras\_2

***stoprecording***

**First building**

stoprecording\_SurveillanceCameras\_1

**Second building**

stoprecording\_SurveillanceCameras\_2

**THERMOSTATS**

On, Off and Schedule operations have been defined for thermostats.

***On***

**First building**

On\_Thermostat\_01, On\_Thermostat\_02, On\_Thermostat\_03, On\_Thermostat\_04,

On\_Thermostat\_05, On\_Thermostat\_06,

On\_Thermostat\_videosurveillanceroom\_1,On\_Thermostat\_gym\_1,On\_Thermostat\_kitchen\_1,On\_Thermostat\_receptionist\_1,On\_Thermostat\_canteen,\_1,On\_Thermostat\_bath\_1

**Second building**

On\_Thermostat\_07, On\_Thermostat\_08, On\_Thermostat\_09, On\_Thermostat\_10,

On\_Thermostat\_11, On\_Thermostat\_12,

On\_Thermostat\_videosurveillanceroom\_2,On\_Thermostat\_gym\_2,On\_Thermostat\_kitchen\_2,On\_Thermostat\_receptionist\_2,On\_Thermostat\_canteen,\_2,On\_Thermostat\_bath\_2

***Off***

**First building**

Off\_Thermostat\_01,Off\_Thermostat\_02,Off\_Thermostat\_03,Off\_Thermostat\_04,

Off\_Thermostat\_05, Off\_Thermostat\_06,

Off\_Thermostat\_videosurveillanceroom\_1,Off\_Thermostat\_gym\_1,Off\_Thermostat\_kitchen\_1,Off\_Thermostat\_receptionist\_1,Off\_Thermostat\_canteen,\_1,Off\_Thermostat\_bath\_1

**Second building**

Off\_Thermostat\_07,Off\_Thermostat\_08,Off\_Thermostat\_09,Off\_Thermostat\_10,

Off\_Thermostat\_11, Off\_Thermostat\_12,

Off\_Thermostat\_videosurveillanceroom\_2,Off\_Thermostat\_gym\_2,Off\_Thermostat\_kitchen\_2,Off\_Thermostat\_receptionist\_2,Off\_Thermostat\_canteen,\_2,Off\_Thermostat\_bath\_2

***Schedule***

**First building**

Schedule\_Thermostat\_01,Schedule\_Thermostat\_02,Schedule\_Thermostat\_03,Schedule\_Thermostat\_04,

Schedule\_Thermostat\_05, Schedule\_Thermostat\_06,

Schedule\_Thermostat\_videosurveillanceroom\_1,Schedule\_Thermostat\_gym\_1,Schedule\_Thermostat\_kitchen\_1,Schedule\_Thermostat\_receptionist\_1,Schedule\_Thermostat\_canteen,\_1,Schedule\_Thermostat\_bath\_1

**Second building**

Schedule\_Thermostat\_07,Schedule\_Thermostat\_08,Schedule\_Thermostat\_09,Schedule\_Thermostat\_10,

Schedule\_Thermostat\_11, Schedule\_Thermostat\_12,

Schedule\_Thermostat\_videosurveillanceroom\_2,Schedule\_Thermostat\_gym\_2,Schedule\_Thermostat\_kitchen\_2,Schedule\_Thermostat\_receptionist\_2,Schedule\_Thermostat\_canteen,\_2,Schedule\_Thermostat\_bath\_2

**SMOKE ALARMS**

The Deactivate operation has been defined for all smoke detectors, this is because it is carried out by a single role.

***Deactivate***

**First building**

Deactivate\_SmokeAlarm\_1

**Second building**

Deactivate\_SmokeAlarm\_2

**BURGLAR ALARMS**

The Activate and Deactivate operations have been defined for all burglar alarms, this is because it is carried out by a single role.**First building**

BurglarAlarm\_01, BurglarAlarm\_02, BurglarAlarm\_03, BurglarAlarm\_04,

BurglarAlarm\_05, BurglarAlarm\_06,

BurglarAlarm\_videosurveillanceroom\_1,BurglarAlarm\_gym\_1,BurglarAlarm\_park\_1,BurglarAlarm\_kitchen\_1,BurglarAlarm\_receptionist\_1,BurglarAlarm\_canteen\_1,BurglarAlarm\_bath\_1

***Activate***

**First building**

Activate\_BurglarAlarm\_1

**Second building**

Activate\_BurglarAlarm\_2

***Deactivate***

**First building**

Deactivate\_BurglarAlarm\_1

**Second building**

Deactivate\_BurglarAlarm\_2

**SAFES**

The On and Off operations have been defined for safes.

***On***

**First building**

On\_Safe\_room2

**Second building**

On\_Safe\_room7

***Off***

**First building**

Off\_Safe\_room2

**Second building**

Off\_Safe\_room7

**MONITORS**

The On and Off operations have been defined for monitors.

***On***

**First building**

On\_Monitor\_receptionist\_1,On\_Monitor\_gym\_1,On\_Monitor\_kitchen\_1,On\_Monitor\_cateen\_1,On\_1Monitor\_videosurveillance\_1,On\_2Monitor\_videosurveillance\_1,On\_3Monitor\_videosurveillance\_1

**Second building**

On\_Monitor\_receptionist\_2,On\_Monitor\_gym\_2,On\_Monitor\_kitchen\_2,On\_Monitor\_cateen\_2,On\_1Monitor\_videosurveillance\_2,On\_2Monitor\_videosurveillance\_2,On\_3Monitor\_videosurveillance\_2

***Off***

Off\_Monitor\_receptionist\_1,Off\_Monitor\_gym\_1,Off\_Monitor\_kitchen\_1,Off\_Monitor\_cateen\_1,Off\_1Monitor\_videosurveillance\_1,Off\_2Monitor\_videosurveillance\_1,Off\_3Monitor\_videosurveillance\_1

**Second building**

Off\_Monitor\_receptionist\_2,Off\_Monitor\_gym\_2,Off\_Monitor\_kitchen\_2,Off\_Monitor\_cateen\_2,Off\_1Monitor\_videosurveillance\_2,Off\_2Monitor\_videosurveillance\_2,Off\_3Monitor\_videosurveillance\_2

**KITCHEN/CANTEEN DEVICES**

The On\_kitchen, off\_kitchen and schedule\_kitchen operations have been defined for all kitchen/canteen devices.

This is because, they are managed by a single role present in the kitchen.

***On***

**First building**

On\_kitchen\_1

**Second building**

On\_kitchen\_2

***Off***

**First building**

off\_kitchen\_1

**Second building**

off\_kitchen\_2

***Schedule***

**First building**

schedule\_kitchen\_1

**Second building**

schedule\_kitchen\_2

**CLEANING DEVICES**

The On\_cleaner and off\_cleaner operations have been defined for all cleaning devices.

This is because, they are managed by a single role.

***On***

**First building**

On\_cleaner\_1

**Second building**

On\_cleaner\_2

***Off***

**First building**

off\_cleaner\_1

**Second building**

off\_cleaner\_2

**COMPUTERS**

One computer was predetermined for each employee, for a total of 68 pcs for the first smart building and the remaining 68 for the second smart building, for a total of 136 pcs.

On\_pc and Off\_pc operations have been defined for each pc, because each employee can have access to every employee pc except the CEO's, managers', and vigilante's pc's, using their own pair of credentials.

***On***

**First building**

On\_Pc\_01, On\_Pc\_02, On\_Pc\_03, On\_Pc\_04, On\_Pc\_05, On\_Pc\_06, On\_Pc\_07, On\_Pc\_08, On\_Pc\_09, On\_Pc\_10, On\_Pc\_11, On\_Pc\_12, On\_Pc\_13, On\_Pc\_14, On\_Pc\_15, On\_Pc\_16, On\_Pc\_17, On\_Pc\_18, On\_Pc\_19, On\_Pc\_20, On\_Pc\_21, On\_Pc\_22, On\_Pc\_23, On\_Pc\_24, On\_Pc\_25, On\_Pc\_26, On\_Pc\_27, On\_Pc\_28, On\_Pc\_29, On\_Pc\_30, On\_Pc\_31, On\_Pc\_32, On\_Pc\_33, On\_Pc\_34, On\_Pc\_35, On\_Pc\_36, On\_Pc\_37, On\_Pc\_38, On\_Pc\_39, On\_Pc\_40, On\_Pc\_41, On\_Pc\_42, On\_Pc\_43, On\_Pc\_44, On\_Pc\_45, On\_Pc\_46, On\_Pc\_47, On\_Pc\_48, On\_Pc\_49, On\_Pc\_50, On\_Pc\_51, On\_Pc\_52, On\_Pc\_53, On\_Pc\_54, On\_Pc\_55, On\_Pc\_56, On\_Pc\_57, On\_Pc\_58, On\_Pc\_59, On\_Pc\_60, On\_Pc\_61, On\_Pc\_62, On\_Pc\_63, On\_Pc\_64, On\_Pc\_65, On\_Pc\_66, On\_Pc\_67, On\_Pc\_68,

On\_pc\_CTO

**Second building**

On\_Pc\_69, On\_Pc\_70, On\_Pc\_71, On\_Pc\_72, On\_Pc\_73, On\_Pc\_74, On\_Pc\_75, On\_Pc\_76, On\_Pc\_77, On\_Pc\_78, On\_Pc\_79, On\_Pc\_80, On\_Pc\_81, On\_Pc\_82, On\_Pc\_83, On\_Pc\_84, On\_Pc\_85, On\_Pc\_86, On\_Pc\_87, On\_Pc\_88, On\_Pc\_89, On\_Pc\_90, On\_Pc\_91, On\_Pc\_92, On\_Pc\_93, On\_Pc\_94, On\_Pc\_95, On\_Pc\_96, On\_Pc\_97, On\_Pc\_98, On\_Pc\_99, On\_Pc\_100, On\_Pc\_101, On\_Pc\_102, On\_Pc\_103, On\_Pc\_104, On\_Pc\_105, On\_Pc\_106, On\_Pc\_107, On\_Pc\_108, On\_Pc\_109, On\_Pc\_110, On\_Pc\_111, On\_Pc\_112, On\_Pc\_113, On\_Pc\_114, On\_Pc\_115, On\_Pc\_116, On\_Pc\_117, On\_Pc\_118, On\_Pc\_119, On\_Pc\_120, On\_Pc\_121, On\_Pc\_122, On\_Pc\_123, On\_Pc\_124, On\_Pc\_125, On\_Pc\_126, On\_Pc\_127, On\_Pc\_128, On\_Pc\_129, On\_Pc\_130, On\_Pc\_131, On\_Pc\_132, On\_Pc\_133, On\_Pc\_134, On\_Pc\_135, On\_Pc\_136,

***Off***

Off\_Pc\_01, Off\_Pc\_02, Off\_Pc\_03, Off\_Pc\_04, Off\_Pc\_05, Off\_Pc\_06, Off\_Pc\_07, Off\_Pc\_08, Off\_Pc\_09, Off\_Pc\_10, Off\_Pc\_11, Off\_Pc\_12, Off\_Pc\_13, Off\_Pc\_14, Off\_Pc\_15, Off\_Pc\_16, Off\_Pc\_17, Off\_Pc\_18, Off\_Pc\_19, Off\_Pc\_20, Off\_Pc\_21, Off\_Pc\_22, Off\_Pc\_23, Off\_Pc\_24, Off\_Pc\_25, Off\_Pc\_26, Off\_Pc\_27, Off\_Pc\_28, Off\_Pc\_29, Off\_Pc\_30, Off\_Pc\_31, Off\_Pc\_32, Off\_Pc\_33, Off\_Pc\_34, Off\_Pc\_35, Off\_Pc\_36, Off\_Pc\_37, Off\_Pc\_38, Off\_Pc\_39, Off\_Pc\_40, Off\_Pc\_41, Off\_Pc\_42, Off\_Pc\_43, Off\_Pc\_44, Off\_Pc\_45, Off\_Pc\_46, Off\_Pc\_47, Off\_Pc\_48, Off\_Pc\_49, Off\_Pc\_50, Off\_Pc\_51, Off\_Pc\_52, Off\_Pc\_53, Off\_Pc\_54, Off\_Pc\_55, Off\_Pc\_56, Off\_Pc\_57, Off\_Pc\_58, Off\_Pc\_59, Off\_Pc\_60, Off\_Pc\_61, Off\_Pc\_62, Off\_Pc\_63, Off\_Pc\_64, Off\_Pc\_65, Off\_Pc\_66, Off\_Pc\_67, Off\_Pc\_68,

Off\_Pc\_CTO

**Second building**

Off\_Pc\_69, Off\_Pc\_70, Off\_Pc\_71, Off\_Pc\_72, Off\_Pc\_73, Off\_Pc\_74, Off\_Pc\_75, Off\_Pc\_76, Off\_Pc\_77, Off\_Pc\_78, Off\_Pc\_79, Off\_Pc\_80, Off\_Pc\_81, Off\_Pc\_82, Off\_Pc\_83, Off\_Pc\_84, Off\_Pc\_85, Off\_Pc\_86, Off\_Pc\_87, Off\_Pc\_88, Off\_Pc\_89, Off\_Pc\_90, Off\_Pc\_91, Off\_Pc\_92, Off\_Pc\_93, Off\_Pc\_94, Off\_Pc\_95, Off\_Pc\_96, Off\_Pc\_97, Off\_Pc\_98, Off\_Pc\_99, Off\_Pc\_100, Off\_Pc\_101, Off\_Pc\_102, Off\_Pc\_103, Off\_Pc\_104, Off\_Pc\_105, Off\_Pc\_106, Off\_Pc\_107, Off\_Pc\_108, Off\_Pc\_109, Off\_Pc\_110, Off\_Pc\_111, Off\_Pc\_112, Off\_Pc\_113, Off\_Pc\_114, Off\_Pc\_115, Off\_Pc\_116, Off\_Pc\_117, Off\_Pc\_118, Off\_Pc\_119, Off\_Pc\_120, Off\_Pc\_121, Off\_Pc\_122, Off\_Pc\_123, Off\_Pc\_124, Off\_Pc\_125, Off\_Pc\_126, Off\_Pc\_127, Off\_Pc\_128, Off\_Pc\_129, Off\_Pc\_130, Off\_Pc\_131, Off\_Pc\_132, Off\_Pc\_133, Off\_Pc\_134, Off\_Pc\_135, Off\_Pc\_136

**First building (ceo\_1)**

Environmental\_data\_storage\_PC\_01

**Second building (ceo\_2)**

Monitoring\_energy\_resources\_PC\_69

**TABLETS**

On\_tablet and Off\_tablet operations were defined for each tablet.

***On***

**First building**

On\_Tablet\_PT\_1, On\_Tablet\_client\_gym\_1, On\_Tablet\_kitchen\_1, On\_Tablet\_waiter\_1

**Second building**

On\_Tablet\_PT\_2, On\_Tablet\_client\_gym\_2, On\_Tablet\_kitchen\_2,

On\_Tablet\_waiter\_2

***Off***

Off\_Tablet\_PT\_1, Off\_Tablet\_client\_gym\_1, Off\_Tablet\_kitchen\_1, Off\_Tablet\_waiter\_1

**Second building**

Off\_Tablet\_PT\_2, Off\_Tablet\_client\_gym\_2, Off\_Tablet\_kitchen\_2,

Off\_Tablet\_waiter\_2

**TAPIRULANS SMART**

On\_tapirulan\_smart,Off\_tapirulan smart and Schedule\_tapirulan\_smart

operations were defined for each tapirulan.

***On***

**First building**

On\_tapirulan\_smart\_1

**Second building**

On\_tapirulan\_smart\_2

***Off***

**First building**

Off\_tapirulan\_smart\_1

**Second building**

Off\_tapirulan\_smart\_2

***Schedule***

**First building**

Schedule\_tapirulan\_smart\_1

**Second building**

Schedule\_tapirulan\_smart\_2

**WIFI**

On\_wifi and Off\_wifi operations were defined for each wifi.

***On***

**First building**

On\_wifi\_all\_1

**Second building**

On\_wifi\_all\_2

***Off***

**First building**

Off\_wifi\_all\_1

**Second building**

Off\_wifi\_all\_2

**SMART FAUCETS**

On\_bath Off\_bath operations were defined for all smart faucets.

***On***

**First building**

On\_bath\_1

**Second building**

On\_bath\_2

***Off***

**First building**

Off\_bath\_1

**Second building**

Off\_bath\_2

**GARAGE DOORS**

Open\_GarageDoor\_park and Close\_GarageDoor\_park operations were defined for the garage doors.

***Open***

**First building**

Open\_GarageDoor\_park\_1

**Second building**

Open\_GarageDoor\_park\_2

***Close***

**First building**

Close\_GarageDoor\_park\_1

**Second building**

Close\_GarageDoor\_park\_2

**ELEVATORS**

Reserve and Select\_plan operations were defined for the elevators.

***Reserve***

**First building**

Reserve\_1

**Second building**

Reserve\_2

***Select***

**First building**

Select\_plan\_1

**Second building**

Select\_plan\_2

**INTELLIGENT SOLAR SYSTEMS**

On\_Intelligent\_solar\_system,Off\_Intelligent\_solar\_system and Schedule\_Intelligent\_solar\_system operations were defined for the intelligent solar systems.

***On***

**First building**

On\_Intelligent\_solar\_system\_1

**Second building**

On\_Intelligent\_solar\_system\_2

***Off***

**First building**

Off\_Intelligent\_solar\_system\_1

**Second building**

Off\_Intelligent\_solar\_system\_2

***Schedule***

**First building**

Schedule\_Intelligent\_solar\_system\_1

**Second building**

Schedule\_Intelligent\_solar\_system\_2

**BIOMETRIC SYSTEMS**

On\_Biometric\_system,Off\_Biometric\_system,search\_in\_DB\_Biometric\_system,insert\_in\_DB\_Biometric\_system and delete\_in\_DB\_Biometric\_system

operations were defined for the biometric systems.

***On***

**First building**

On\_ Biometric\_system\_1

**Second building**

On\_Biometric\_system\_2

***Off***

**First building**

Off\_ Biometric\_system\_1

**Second building**

Off\_Biometric\_system\_2

***Search***

**First building**

search\_in\_DB\_Biometric\_system\_1

**Second building**

search\_in\_DB\_Biometric\_system\_2

***Insert***

**First building**

insert\_in\_DB\_Biometric\_system\_1

**Second building**

insert\_in\_DB\_Biometric\_system\_2

***Delete***

**First building**

delete\_in\_DB\_Biometric\_system\_1

**Second building**

delete\_in\_DB\_Biometric\_system\_2

}

Device Roles (DR) are used to categorize the permissions of different devices. The many-to-many PDRA relation specifies this assignment.

**DR** = { Entertainment\_Device, Door\_Device, Advanced\_Device, Safe\_Device, Biometric\_Device, Biometric\_Controlled, Computer\_Device, Tablet\_Device, Fitness\_Device, Fitness\_PT\_Device, Garage\_Device, Wifi\_Device, Kitchen\_Device, Monitor\_Device, Security\_Device, Lighting\_Device, Cleaning\_Device, Work\_Device, Common\_Device, BMS\_Devices, HVAC\_Devices, CTO\_Private\_pc, Environmental\_data\_storage, Monitoring\_energy\_resources}

**DOORS**

Various door permissions have been defined separately, because, for example, not everyone can access the doors to the surveillance room, in contrast to the doors to the bathrooms where anyone has access.

As in the previous steps, the various permissions of the two smart buildings are distinguished by means of \_1 and \_2.

**First building**

**P1** = {DoorLock\_01, DoorLock\_02,DoorLock\_03,DoorLock\_04,DoorLock\_05,DoorLock\_06} ×

{Lock\_01,Lock\_02,Lock\_03,Lock\_04,Lock\_05,Lock\_06,Unlock\_01,Unlock\_02,Unlock\_03,Unlock\_04,Unlock\_05,Unlock\_06}

**P2**= {DoorLock\_ videosurveillanceroom\_1}x{Lock\_videosurveillanceroom\_1, Unlock\_videosurveillanceroom\_1}

**P3**= {DoorLock\_gym\_1, DoorLock\_park\_1}x{ Lock\_gym\_1, Lock\_park\_1, Unlock\_gym\_1, Unlock\_park\_1}

**P4**= { DoorLock\_kitchen\_1}x{ Lock\_kitchen\_1, Unlock\_kitchen\_1}

**P5**= { DoorLock\_cateen\_1 }x{ Lock\_cateen\_1, Unlock\_cateen\_1}

**P6**= { DoorLock\_receptionist\_1}x{ Lock\_receptionist\_1, Unlock\_receptionist\_1}

**P7**= { DoorLock\_bath\_1}x{ Lock\_bath\_1, Unlock\_bath\_1}

**Second building**

**P8** = {DoorLock\_07, DoorLock\_08,DoorLock\_09,DoorLock\_10,DoorLock\_11,DoorLock\_12} ×

{Lock\_07,Lock\_08,Lock\_09,Lock\_10,Lock\_11,Lock\_12,Unlock\_07,Unlock\_08,Unlock\_09,Unlock\_10,Unlock\_11,Unlock\_12}

**P9**= {DoorLock\_videosurveillanceroom\_2}x{Lock\_videosurveillanceroom\_2, Unlock\_videosurveillanceroom\_2}

**P10**= {DoorLock\_gym\_2, DoorLock\_park\_2}x{ Lock\_gym\_2, Lock\_park\_2, Unlock\_gym\_2, Unlock\_park\_2}

**P11**= { DoorLock\_kitchen\_2}x{ Lock\_kitchen\_2, Unlock\_kitchen\_2}

**P12**= { DoorLock\_cateen\_2 }x{ Lock\_cateen\_2, Unlock\_cateen\_2}

**P13**= { DoorLock\_receptionist\_2}x{ Lock\_receptionist\_2, Unlock\_receptionist\_2}

**P14** = { DoorLock\_bath\_2}x{ Lock\_bath\_2, Unlock\_bath\_2}

**LIGHTS**

Various lights permissions have been defined separately, because, for example, not everyone can on the lights to the surveillance room, in contrast to the lights to the bathrooms where anyone has on.

As in the previous steps, the various permissions of the two smart buildings are distinguished by means of \_1 and \_2.

**First building**

**P15** = { Lights\_01,Lights\_02,Lights\_03,Lights\_04,Lights\_05,Lights\_06 } ×

{On\_Lights\_01, On\_Lights\_02,On\_Lights\_03,On\_Lights\_04, On\_Lights\_05, On\_Lights\_06, Off\_Lights\_01,Off\_Lights\_02,Off\_Lights\_03,Off\_Lights\_04, Off\_Lights\_05, Off\_Lights\_06}

**P16**= {Lights\_videosurveillanceroom\_1}x{ On\_Lights\_videosurveillanceroom\_1, Off\_Lights\_videosurveillanceroom\_1}

**P17**= {Lights\_gym\_1, Lights\_park\_1}x{ On\_Lights\_gym\_1, Off\_gym\_1, On\_Lights\_park\_1, Off\_park\_1}

**P18**= {Lights\_kitchen\_1 }x{ On\_Lights\_kitchen\_1, Off\_kitchen\_1}

**P19**= {Lights\_cateen\_1 }x{ { On\_Lights\_cateen\_1, { Off\_Lights\_cateen\_1}

**P20**= {Lights\_receptionist\_1}x{ On\_Lights\_receptionist\_1, Off\_Lights\_receptionist\_1}

**P21**= {Lights\_bath\_1}x{ On\_Lights\_bath\_1, Off\_Lights\_bath\_1}

**Second building**

**P22** = { Lights\_07,Lights\_08,Lights\_09,Lights\_10,Lights\_11,Lights\_12 } ×

{On\_Lights\_07, On\_Lights\_08,On\_Lights\_09,On\_Lights\_10, On\_Lights\_11, On\_Lights\_12, Off\_Lights\_07,Off\_Lights\_08,Off\_Lights\_09,Off\_Lights\_10, Off\_Lights\_11, Off\_Lights\_12}

**P23**= {Lights\_videosurveillanceroom\_2}x{ On\_Lights\_videosurveillanceroom\_2, Off\_Lights\_videosurveillanceroom\_2}

**P24**= {Lights\_gym\_2, Lights\_park\_2}x{ On\_Lights\_gym\_2, Off\_gym\_2, On\_Lights\_park\_2, Off\_park\_2}

**P25**= {Lights\_kitchen\_2 }x{ On\_Lights\_kitchen\_2, Off\_kitchen\_2}

**P26**= {Lights\_cateen\_2 }x{ { On\_Lights\_cateen\_2, { Off\_Lights\_cateen\_2}

**P27**= {Lights\_receptionist\_2}x{ On\_Lights\_receptionist\_2, Off\_Lights\_receptionist\_2}

**P28**= {Lights\_bath\_2}x{ On\_Lights\_bath\_2, Off\_Lights\_bath\_2}

**ALEXA**

Permissions for Alexa in different smart buildings have been defined.

**First building**

**P29**={Alexa\_01,Alexa\_02,Alexa\_03,Alexa\_04,Alexa\_05,Alexa\_06}x{Activate\_Alexa\_01,Activate\_Alexa\_02,Activate\_Alexa\_03,Activate\_Alexa\_04,Activate\_Alexa\_05,Activate\_Alexa\_06,Deactivate\_Alexa\_01,Deactivate\_Alexa\_02,Deactivate\_Alexa\_03,Deactivate\_Alexa\_04,Deactivate\_Alexa\_05,Deactivate\_Alexa\_06}

**Second building**

**P30**={Alexa\_07,Alexa\_08,Alexa\_09,Alexa\_10,Alexa\_11,Alexa\_12}x{Activate\_Alexa\_07,Activate\_Alexa\_08,Activate\_Alexa\_09,Activate\_Alexa\_10,Activate\_Alexa\_11,Activate\_Alexa\_12,Deactivate\_Alexa\_07,Deactivate\_Alexa\_08,Deactivate\_Alexa\_09,Deactivate\_Alexa\_10,Deactivate\_Alexa\_11,Deactivate\_Alexa\_12}

**VIDEO SURVEILLANCE CAMERAS**

Permissions for video surveillance cameras in different smart buildings have been defined.

**First building**

**P31**={SurveillanceCameras\_parking\_1,SurveillanceCameras\_gym\_1,SurveillanceCameras\_kitchen\_1,SurveillanceCameras\_receptionist\_1,SurveillanceCameras\_canteen\_1,SurveillanceCameras\_videosurveillanceroom\_1,SurveillanceCameras\_firstfloorcorridor\_1,SurveillanceCameras\_secondfloorcorridor\_1,SurveillanceCameras\_thirdfloorcorridor\_1} x { startrecording\_SurveillanceCameras\_1, stoprecording\_SurveillanceCameras\_1}

**Second building**

**P32**={SurveillanceCameras\_parking\_2,SurveillanceCameras\_gym\_2,SurveillanceCameras\_kitchen\_2,SurveillanceCameras\_receptionist\_2,SurveillanceCameras\_canteen\_2,SurveillanceCameras\_videosurveillanceroom\_2,SurveillanceCameras\_firstfloorcorridor\_2,SurveillanceCameras\_secondfloorcorridor\_2,SurveillanceCameras\_thirdfloorcorridor\_2} x { startrecording\_SurveillanceCameras\_2, stoprecording\_SurveillanceCameras\_2}

**THERMOSTATS**

Permissions for thermostats in different smart buildings have been defined.

**First building**

**P33=**{Thermostat\_01,Thermostat\_02,Thermostat\_03,Thermostat\_04,Thermostat\_05,Thermostat\_06,Thermostat\_videosurveillanceroom\_1,Thermostat\_gym\_1,Thermostat\_park\_1,Thermostat\_kitchen\_1,Thermostat\_receptionist\_1,Thermostat\_canteen\_1,Thermostat\_bath\_1 } **×** {On\_Thermostat\_01,On\_Thermostat\_02,On\_Thermostat\_03,On\_Thermostat\_04

On\_Thermostat\_05,On\_Thermostat\_06,On\_Thermostat\_videosurveillanceroom\_1,On\_Thermostat\_gym\_1,On\_Thermostat\_kitchen\_1,On\_Thermostat\_receptionist\_1,On\_Thermostat\_canteen\_1,On\_Thermostat\_bath\_1,Off\_Thermostat\_01,Off\_Thermostat\_02,Off\_Thermostat\_03,Off\_Thermostat\_04 ,Off\_Thermostat\_05, Off\_Thermostat\_06,Off\_Thermostat\_videosurveillanceroom\_1 ,Off\_Thermostat\_gym\_1, Off\_Thermostat\_kitchen\_1,Off\_Thermostat\_receptionist\_1,Off\_Thermostat\_canteen\_1,Off\_Thermostat\_bath\_1,Schedule\_Thermostat\_01,Schedule\_Thermostat\_02,Schedule\_Thermostat\_03,Schedule\_Thermostat\_04,Schedule\_Thermostat\_05,Schedule\_Thermostat\_06,Schedule\_Thermostat\_videosurveillanceroom\_1,Schedule\_Thermostat\_gym\_1,Schedule\_Thermostat\_kitchen\_1,Schedule\_Thermostat\_receptionist\_1,Schedule\_Thermostat\_canteen\_1,Schedule\_Thermostat\_bath\_1}

**Second building**

**P34=**{Thermostat\_07,Thermostat\_08,Thermostat\_09,Thermostat\_10,Thermostat\_11,Thermostat\_12,Thermostat\_videosurveillanceroom\_2,Thermostat\_gym\_2,Thermostat\_park\_2,Thermostat\_kitchen\_2,Thermostat\_receptionist\_2,Thermostat\_canteen\_2,Thermostat\_bath\_2 } **×** {On\_Thermostat\_07,On\_Thermostat\_08,On\_Thermostat\_09,On\_Thermostat\_10

On\_Thermostat\_11,On\_Thermostat\_12,On\_Thermostat\_videosurveillanceroom\_2,On\_Thermostat\_gym\_2,On\_Thermostat\_kitchen\_2,On\_Thermostat\_receptionist\_2,On\_Thermostat\_canteen\_2,On\_Thermostat\_bath\_2,Off\_Thermostat\_07,Off\_Thermostat\_08,Off\_Thermostat\_09,Off\_Thermostat\_10 ,Off\_Thermostat\_11,

Off\_Thermostat\_12,Off\_Thermostat\_videosurveillanceroom\_2 ,Off\_Thermostat\_gym\_2, Off\_Thermostat\_kitchen\_2,Off\_Thermostat\_receptionist\_2,Off\_Thermostat\_canteen\_2,Off\_Thermostat\_bath\_2,Schedule\_Thermostat\_07,Schedule\_Thermostat\_08,Schedule\_Thermostat\_09,Schedule\_Thermostat\_10,Schedule\_Thermostat\_11,Schedule\_Thermostat\_12,Schedule\_Thermostat\_videosurveillanceroom\_2,Schedule\_Thermostat\_gym\_2,Schedule\_Thermostat\_kitchen\_2,Schedule\_Thermostat\_receptionist\_2,Schedule\_Thermostat\_canteen\_2,Schedule\_Thermostat\_bath\_2}

**SMOKE ALARMS**

Permissions for smoke alarms in different smart buildings have been defined.

**First building**

**P35=**{SmokeAlarm\_01,SmokeAlarm\_02,SmokeAlarm\_03,SmokeAlarm\_04,SmokeAlarm\_05,SmokeAlarm\_06,SmokeAlarm\_videosurveillanceroom\_1,SmokeAlarm\_gym\_1,SmokeAlarm\_park\_1,SmokeAlarm\_kitchen\_1,SmokeAlarm\_receptionist\_1,SmokeAlarm\_canteen\_1,SmokeAlarm\_bath\_1} × {DeactiveSmokeAlarm\_1}

**Second building**

**P36=**{SmokeAlarm\_07,SmokeAlarm\_08,SmokeAlarm\_09,SmokeAlarm\_20,SmokeAlarm\_21,SmokeAlarm\_22,SmokeAlarm\_videosurveillanceroom\_2,SmokeAlarm\_gym\_2,SmokeAlarm\_park\_2,SmokeAlarm\_kitchen\_2,SmokeAlarm\_receptionist\_2,SmokeAlarm\_canteen\_2,SmokeAlarm\_bath\_2} × {DeactiveSmokeAlarm\_2}

**BURGLAR ALARMS**

Permissions for burglar alarms in different smart buildings have been defined.

**First building**

**P37**={BurglarAlarm\_01, BurglarAlarm\_02, BurglarAlarm\_03, BurglarAlarm\_04,BurglarAlarm\_05,BurglarAlarm\_06,BurglarAlarm\_ videosurveillanceroom\_1,BurglarAlarm\_gym\_1,BurglarAlarm\_park\_1,BurglarAlarm\_kitchen\_1,BurglarAlarm\_receptionist\_1,BurglarAlarm\_canteen\_1,BurglarAlarm\_bath\_1} **×** {Activate\_BurglarAlarm\_1, Deactivate\_BurglarAlarm\_1}

**Second building**

**P38**={BurglarAlarm\_07, BurglarAlarm\_08, BurglarAlarm\_09, BurglarAlarm\_20,BurglarAlarm\_21,BurglarAlarm\_22,BurglarAlarm\_ videosurveillanceroom\_2,BurglarAlarm\_gym\_2,BurglarAlarm\_park\_2,BurglarAlarm\_kitchen\_2,BurglarAlarm\_receptionist\_2,BurglarAlarm\_canteen\_2,BurglarAlarm\_bath\_2} **×** {Activate\_BurglarAlarm\_2, Deactivate\_BurglarAlarm\_2}

**SAFES**

Permissions for safes in different smart buildings have been defined.

**First building**

**P39**={Safe\_room2} x {On\_Safe\_room2, Off\_Safe\_room2}

**Second building**

**P40**={Safe\_room7} x {On\_Safe\_room7, Off\_Safe\_room7}

**MONITORS**

Various monitors permissions have been defined separately, because, for example, not everyone can on the monitors to the receptionist room.

**First building**

**P41** = {Monitor\_receptionist\_1} × {On\_Monitor\_receptionist\_1, Off\_Monitor\_receptionist\_1}

**P42** = {Monitor\_gym\_1} × {On\_Monitor\_gym\_1, Off\_Monitor\_gym\_1}

**P43**= {Monitor\_kitchen\_1} × {On\_Monitor\_kitchen\_1, Off\_Monitor\_kitchen\_1}

**P44**= {Monitor\_cateen\_1} × {On\_Monitor\_cateen\_1, Off\_Monitor\_cateen\_1}

**P45** = {1Monitor\_videosurveillance\_1} × {On\_1Monitor\_ videosurveillance\_1, Off\_1Monitor\_videosurveillance\_1}

**P46** = {2Monitor\_videosurveillance\_1} x {On\_2Monitor\_videosurveillance\_1, Off\_2Monitor\_videosurveillance\_1}

**P47**= {3Monitor\_videosurveillance\_1} x {On\_3Monitor\_videosurveillance\_1, Off\_3Monitor\_videosurveillance\_1}

**Second building**

**P48** = {Monitor\_receptionist\_2} × {On\_Monitor\_receptionist\_2, Off\_Monitor\_receptionist\_2}

**P49** = {Monitor\_gym\_2} × {On\_Monitor\_gym\_2, Off\_Monitor\_gym\_2}

**P50**= {Monitor\_kitchen\_2} × {On\_Monitor\_kitchen\_2, Off\_Monitor\_kitchen\_2}

**P51**= {Monitor\_cateen\_2} × {On\_Monitor\_cateen\_2, Off\_Monitor\_cateen\_2}

**P52** = {1Monitor\_videosurveillance\_2} × {On\_2Monitor\_ videosurveillance\_2, Off\_2Monitor\_videosurveillance\_2}

**P53** = {2Monitor\_videosurveillance\_2} x {On\_2Monitor\_videosurveillance\_2, Off\_2Monitor\_videosurveillance\_2}

**P54**= {3Monitor\_videosurveillance\_2} x {On\_3Monitor\_videosurveillance\_2, Off\_3Monitor\_videosurveillance\_2}

**KITCHEN/CANTEEN DEVICES**

Permissions for kitchen devices in different smart buildings have been defined.

**First building**

**P55**={ Oven\_1,Fridge\_1, DishWasher\_1, SmartCookware&Cooktop\_1, FoodProcessor,IceMaker\_1, SmartCoffeeMachine\_cateen\_1 } x { On\_kitchen\_1, off\_kitchen\_1, schedule\_kitchen\_1}

**Second building**

**P56**={ Oven\_2,Fridge\_2, DishWasher\_2, SmartCookware&Cooktop\_2, FoodProcessor,IceMaker\_2, SmartCoffeeMachine\_cateen\_2 } x { On\_kitchen\_2, off\_kitchen\_2, schedule\_kitchen\_2}

**CLEANING DEVICES**

Permissions for cleaning devices in different smart buildings have been defined.

**First building**

**P57**={ SmartRobotVacuumCleaner\_1, Robotlawnmower\_1 } x { On\_cleaner\_1, off\_cleaner\_1}

**Second building**

**P58**={ SmartRobotVacuumCleaner\_2, Robotlawnmower\_2 } x { On\_cleaner\_2, off\_cleaner\_2}

**COMPUTERS**

Permissions for Pcs in different smart buildings have been defined.

**First building**

**P59**={Pc\_01} x {On\_Pc\_01,Off\_Pc\_01}

**P60**={Pc\_02} x {On\_Pc\_02,Off\_Pc\_02}

**P61**={Pc\_03} x {On\_Pc\_03,Off\_Pc\_03}

**P62**={Pc\_04} x {On\_Pc\_04,Off\_Pc\_04}

**P63**={Pc\_05} x {On\_Pc\_05,Off\_Pc\_05}

**P64**={Pc\_06} x {On\_Pc\_06,Off\_Pc\_06}

**P65**={Pc\_07} x {On\_Pc\_07,Off\_Pc\_07}

**P66**={Pc\_08} x {On\_Pc\_08,Off\_Pc\_08}

**P67**={Pc\_09} x {On\_Pc\_09,Off\_Pc\_09}

**P68**={Pc\_10} x {On\_Pc\_10,Off\_Pc\_10}

**P69**={Pc\_11} x {On\_Pc\_11,Off\_Pc\_11}

**P70**={Pc\_12} x {On\_Pc\_12,Off\_Pc\_12}

**P71**={Pc\_13} x {On\_Pc\_13,Off\_Pc\_13}

**P72**={Pc\_14} x {On\_Pc\_14,Off\_Pc\_14}

**P73**={Pc\_15} x {On\_Pc\_15,Off\_Pc\_15}

**P74**={Pc\_16} x {On\_Pc\_16,Off\_Pc\_16}

**P75**={Pc\_17} x {On\_Pc\_17,Off\_Pc\_17}

**P76**={Pc\_18} x {On\_Pc\_18,Off\_Pc\_18}

**P77**={Pc\_19} x {On\_Pc\_19,Off\_Pc\_19}

**P78**={Pc\_20} x {On\_Pc\_20,Off\_Pc\_20}

**P79**={Pc\_21} x {On\_Pc\_21,Off\_Pc\_21}

**P80**={Pc\_22} x {On\_Pc\_22,Off\_Pc\_22}

**P81**={Pc\_23} x {On\_Pc\_23,Off\_Pc\_23}

**P82**={Pc\_24} x {On\_Pc\_24,Off\_Pc\_24}

**P83**={Pc\_25} x {On\_Pc\_25,Off\_Pc\_25}

**P84**={Pc\_26} x {On\_Pc\_26,Off\_Pc\_26}

**P85**={Pc\_27} x {On\_Pc\_27,Off\_Pc\_27}

**P86**={Pc\_28} x {On\_Pc\_28,Off\_Pc\_28}

**P87**={Pc\_29} x {On\_Pc\_29,Off\_Pc\_29}

**P88**={Pc\_30} x {On\_Pc\_30,Off\_Pc\_30}

**P89**={Pc\_31} x {On\_Pc\_31,Off\_Pc\_31}

**P90**={Pc\_32} x {On\_Pc\_32,Off\_Pc\_32}

**P91**={Pc\_33} x {On\_Pc\_33,Off\_Pc\_33}

**P92**={Pc\_34} x {On\_Pc\_34,Off\_Pc\_34}

**P93**={Pc\_35} x {On\_Pc\_35,Off\_Pc\_35}

**P94**={Pc\_36} x {On\_Pc\_36,Off\_Pc\_36}

**P95**={Pc\_37} x {On\_Pc\_37,Off\_Pc\_37}

**P96**={Pc\_38} x {On\_Pc\_38,Off\_Pc\_38}

**P97**={Pc\_39} x {On\_Pc\_39,Off\_Pc\_39}

**P98**={Pc\_40} x {On\_Pc\_40,Off\_Pc\_40}

**P99**={Pc\_41} x {On\_Pc\_41,Off\_Pc\_41}

**P100**={Pc\_42} x {On\_Pc\_42,Off\_Pc\_42}

**P101**={Pc\_43} x {On\_Pc\_43,Off\_Pc\_43}

**P102**={Pc\_44} x {On\_Pc\_44,Off\_Pc\_44}

**P103**={Pc\_45} x {On\_Pc\_45,Off\_Pc\_45}

**P104**={Pc\_46} x {On\_Pc\_46,Off\_Pc\_46}

**P105**={Pc\_47} x {On\_Pc\_47,Off\_Pc\_47}

**P106**={Pc\_48} x {On\_Pc\_48,Off\_Pc\_48}

**P107**={Pc\_49} x {On\_Pc\_49,Off\_Pc\_49}

**P108**={Pc\_50} x {On\_Pc\_50,Off\_Pc\_50}

**P109**={Pc\_51} x {On\_Pc\_51,Off\_Pc\_51}

**P110**={Pc\_52} x {On\_Pc\_52,Off\_Pc\_52}

**P111**={Pc\_53} x {On\_Pc\_53,Off\_Pc\_53}

**P112**={Pc\_54} x {On\_Pc\_54,Off\_Pc\_54}

**P113**={Pc\_55} x {On\_Pc\_55,Off\_Pc\_55}

**P114**={Pc\_56} x {On\_Pc\_56,Off\_Pc\_56}

**P115**={Pc\_57} x {On\_Pc\_57,Off\_Pc\_57}

**P116**={Pc\_58} x {On\_Pc\_58,Off\_Pc\_58}

**P117**={Pc\_59} x {On\_Pc\_59,Off\_Pc\_59}

**P118**={Pc\_60} x {On\_Pc\_60,Off\_Pc\_60}

**P119**={Pc\_61} x {On\_Pc\_61,Off\_Pc\_61}

**P120**={Pc\_62} x {On\_Pc\_62,Off\_Pc\_62}

**P121**={Pc\_63} x {On\_Pc\_63,Off\_Pc\_63}

**P122**={Pc\_64} x {On\_Pc\_64,Off\_Pc\_64}

**P123**={Pc\_65} x {On\_Pc\_65,Off\_Pc\_65}

**P124**={Pc\_66} x {On\_Pc\_66,Off\_Pc\_66}

**P125**={Pc\_67} x {On\_Pc\_67,Off\_Pc\_67}

**P126**={Pc\_68} x {On\_Pc\_68,Off\_Pc\_68}

**Second building**

|  |
| --- |
| **P127**={Pc\_69} x {On\_Pc\_69,Off\_Pc\_69} |
| **P128**={Pc\_70} x {On\_Pc\_70,Off\_Pc\_70} |
| **P129**={Pc\_71} x {On\_Pc\_71,Off\_Pc\_71} |
| **P130**={Pc\_72} x {On\_Pc\_72,Off\_Pc\_72} |
| **P131**={Pc\_73} x {On\_Pc\_73,Off\_Pc\_73} |
| **P132**={Pc\_74} x {On\_Pc\_74,Off\_Pc\_74} |
| **P133**={Pc\_75} x {On\_Pc\_75,Off\_Pc\_75} |
| **P134**={Pc\_76} x {On\_Pc\_76,Off\_Pc\_76} |
| **P135**={Pc\_77} x {On\_Pc\_77,Off\_Pc\_77} |
| **P136**={Pc\_78} x {On\_Pc\_78,Off\_Pc\_78} |
| **P137**={Pc\_79} x {On\_Pc\_79,Off\_Pc\_79} |
| **P138**={Pc\_80} x {On\_Pc\_80,Off\_Pc\_80} |
| **P139**={Pc\_81} x {On\_Pc\_81,Off\_Pc\_81} |
| **P140**={Pc\_82} x {On\_Pc\_82,Off\_Pc\_82} |
| **P141**={Pc\_83} x {On\_Pc\_83,Off\_Pc\_83} |
| **P142**={Pc\_84} x {On\_Pc\_84,Off\_Pc\_84} |
| **P143**={Pc\_85} x {On\_Pc\_85,Off\_Pc\_85} |
| **P144**={Pc\_86} x {On\_Pc\_86,Off\_Pc\_86} |
| **P145**={Pc\_87} x {On\_Pc\_87,Off\_Pc\_87} |
| **P146**={Pc\_88} x {On\_Pc\_88,Off\_Pc\_88} |
| **P147**={Pc\_89} x {On\_Pc\_89,Off\_Pc\_89} |
| **P148**={Pc\_90} x {On\_Pc\_90,Off\_Pc\_90} |
| **P149**={Pc\_91} x {On\_Pc\_91,Off\_Pc\_91} |
| **P150**={Pc\_92} x {On\_Pc\_92,Off\_Pc\_92} |
| **P151**={Pc\_93} x {On\_Pc\_93,Off\_Pc\_93} |
| **P152**={Pc\_94} x {On\_Pc\_94,Off\_Pc\_94} |
| **P153**={Pc\_95} x {On\_Pc\_95,Off\_Pc\_95} |
| **P154**={Pc\_96} x {On\_Pc\_96,Off\_Pc\_96} |
| **P155**={Pc\_97} x {On\_Pc\_97,Off\_Pc\_97} |
| **P156**={Pc\_98} x {On\_Pc\_98,Off\_Pc\_98} |
| **P157**={Pc\_99} x {On\_Pc\_99,Off\_Pc\_99} |
| **P158**={Pc\_100} x {On\_Pc\_100,Off\_Pc\_100} |
| **P159**={Pc\_101} x {On\_Pc\_101,Off\_Pc\_101} |
| **P160**={Pc\_102} x {On\_Pc\_102,Off\_Pc\_102} |
| **P161**={Pc\_103} x {On\_Pc\_103,Off\_Pc\_103} |
| **P162**={Pc\_104} x {On\_Pc\_104,Off\_Pc\_104} |
| **P163**={Pc\_105} x {On\_Pc\_105,Off\_Pc\_105} |
| **P164**={Pc\_106} x {On\_Pc\_106,Off\_Pc\_106} |
| **P165**={Pc\_107} x {On\_Pc\_107,Off\_Pc\_107} |
| **P166**={Pc\_108} x {On\_Pc\_108,Off\_Pc\_108} |
| **P167**={Pc\_109} x {On\_Pc\_109,Off\_Pc\_109} |
| **P168**={Pc\_110} x {On\_Pc\_110,Off\_Pc\_110} |
| **P169**={Pc\_111} x {On\_Pc\_111,Off\_Pc\_111} |
| **P170**={Pc\_112} x {On\_Pc\_112,Off\_Pc\_112} |
| **P171**={Pc\_113} x {On\_Pc\_113,Off\_Pc\_113} |
| **P172**={Pc\_114} x {On\_Pc\_114,Off\_Pc\_114} |
| **P173**={Pc\_115} x {On\_Pc\_115,Off\_Pc\_115} |
| **P174**={Pc\_116} x {On\_Pc\_116,Off\_Pc\_116} |
| **P175**={Pc\_117} x {On\_Pc\_117,Off\_Pc\_117} |
| **P176**={Pc\_118} x {On\_Pc\_118,Off\_Pc\_118} |
| **P177**={Pc\_119} x {On\_Pc\_119,Off\_Pc\_119} |
| **P178**={Pc\_120} x {On\_Pc\_120,Off\_Pc\_120} |
| **P179**={Pc\_121} x {On\_Pc\_121,Off\_Pc\_121} |
| **P180**={Pc\_122} x {On\_Pc\_122,Off\_Pc\_122} |
| **P181**={Pc\_123} x {On\_Pc\_123,Off\_Pc\_123} |
| **P182**={Pc\_124} x {On\_Pc\_124,Off\_Pc\_124} |
| **P183**={Pc\_125} x {On\_Pc\_125,Off\_Pc\_125} |
| **P184**={Pc\_126} x {On\_Pc\_126,Off\_Pc\_126} |
| **P185**={Pc\_127} x {On\_Pc\_127,Off\_Pc\_127} |
| **P186**={Pc\_128} x {On\_Pc\_128,Off\_Pc\_128} |
| **P187**={Pc\_129} x {On\_Pc\_129,Off\_Pc\_129} |
| **P188**={Pc\_130} x {On\_Pc\_130,Off\_Pc\_130} |
| **P189**={Pc\_131} x {On\_Pc\_131,Off\_Pc\_131} |
| **P190**={Pc\_132x {On\_Pc\_132,Off\_Pc\_132} |
| **P191**={Pc\_133} x {On\_Pc\_133,Off\_Pc\_133} |
| **P192**={Pc\_134} x {On\_Pc\_134,Off\_Pc\_134} |
| **P193**={Pc\_135} x {On\_Pc\_135,Off\_Pc\_135} |
| **P194**={Pc\_136} x {On\_Pc\_136,Off\_Pc\_136} |

**TABLETS**

Permissions for tablets in different smart buildings have been defined.

**First building**

**P195**={Tablet\_PT\_1} x { On\_Tablet\_PT\_1, Off\_Tablet\_PT\_1}

**P196**={Tablet\_client\_gym\_1} x { On\_Tablet\_client\_gym\_1, Off\_Tablet\_client\_gym\_1 }

**P197**={Tablet\_kitchen\_1} x { On\_ Tablet\_kitchen\_1, Off\_ Tablet\_kitchen\_1}

**P198**={1Tablet\_waiter\_1, 2Tablet\_waiter\_1, 3Tablet\_waiter\_1, 4Tablet\_waiter\_1 } x { On\_Tablet\_waiter\_1, Off\_Tablet\_waiter\_1}

**Second Building**

**P199**={Tablet\_PT\_2} x { On\_Tablet\_PT\_2, Off\_Tablet\_PT\_2}

**P200**={Tablet\_client\_gym\_2} x { On\_Tablet\_client\_gym\_2, Off\_Tablet\_client\_gym\_2 }

**P201**={Tablet\_kitchen\_2} x { On\_ Tablet\_kitchen\_2, Off\_ Tablet\_kitchen\_2}

**P202**={1Tablet\_waiter\_2, 2Tablet\_waiter\_2, 3Tablet\_waiter\_2, 4Tablet\_waiter\_2 } x { On\_Tablet\_waiter\_2, Off\_Tablet\_waiter\_2}

**TAPIRULANS SMART**

Permissions for tapirulans in different smart buildings have been defined.

**First building**

**P203**={Tapirulan\_smart\_1} x { On\_Tapirulan\_smart\_1, Off\_Tapirulan\_smart\_1 }

**Second Building**

**P204**={Tapirulan\_smart\_2} x { On\_Tapirulan\_smart\_2, Off\_Tapirulan\_smart\_2 }

**WIFI**

Permissions for wifi in different smart buildings have been defined.

**First building**

**P205**={Wifi\_all\_1} x { On\_wifi\_1, Off\_wifi\_1}

**Second Building**

**P206**={Wifi\_all\_2} x { On\_wifi\_2, Off\_wifi\_2}

**SMART FAUCETS**

Permissions for faucets in different smart buildings have been defined.

**First building**

**P207**={ Smartfaucet\_bath\_1} x { On\_bath\_1, Off\_bath\_1}

**Second Building**

**P208**={ Smartfaucet\_bath\_2} x { On\_bath\_2, Off\_bath\_2}

**GARAGE DOORS**

Permissions for garage doors in different smart buildings have been defined.

**First building**

**P209**={ GarageDoor\_park\_1} x { Open\_GarageDoor\_park\_1, Close\_GarageDoor\_park\_1}

**Second Building**

**P210**={ GarageDoor\_park\_2} x { Open\_GarageDoor\_park\_2, Close\_GarageDoor\_park\_2}

**ELEVATORS**

Permissions for elevators in different smart buildings have been defined.

**First building**

**P211**={ Elevator\_1} x { Reserve\_1, Select\_plan\_1}

**Second Building**

**P212**={ Elevator\_2} x { Reserve\_2, Select\_plan\_2}

**INTELLIGENT SOLAR SYSTEMS**

Permissions for solar systems in different smart buildings have been defined.

**First building**

**P213**={intelligent\_solar\_system\_1} x { On\_ intelligent\_solar\_system\_1, Off\_ intelligent\_solar\_system\_1, schedule\_intelligent\_solar\_system\_1 }

**Second Building**

**P214**={intelligent\_solar\_system\_2} x { On\_ intelligent\_solar\_system\_2, Off\_ intelligent\_solar\_system\_2, schedule\_intelligent\_solar\_system\_2 }

**BIOMETRIC SYSTEMS**

The various permissions of biometric systems have been defined separately, because, On, Off and search operations can be done by anyone, unlike Insert and delete which can only be done by a higher role.

**First building**

**P215**={ Biometric\_system\_1 } x { On\_ Biometric\_system\_1, Off\_Biometric\_system\_1, search\_in\_DB\_Biometric\_system\_1, insert\_in\_DB\_Biometric\_system\_1, delete\_in\_DB\_Biometric\_system\_1 }

**P216**={ Biometric\_system\_1 } x { On\_ Biometric\_system\_1, Off\_Biometric\_system\_1, search\_in\_DB\_Biometric\_system\_1}

**Second Building**

**P217**={ Biometric\_system\_2 } x { On\_ Biometric\_system\_2, Off\_Biometric\_system\_2, search\_in\_DB\_Biometric\_system\_2, insert\_in\_DB\_Biometric\_system\_2, delete\_in\_DB\_Biometric\_system\_2 }

**P218**={ Biometric\_system\_2 } x { On\_ Biometric\_system\_2, Off\_Biometric\_system\_2, search\_in\_DB\_Biometric\_system\_2}

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**BMS\_DEVICES**

Permissions for BMS in different smart buildings have been defined.

**Temperature Sensor**

**First building**

**P219=**{TemperatureSensor\_01,TemperatureSensor\_02,TemperatureSensor\_03,TemperatureSensor\_04,TemperatureSensor\_05,TemperatureSensor\_06,TemperatureSensor\_videosurveillanceroom\_1,TemperatureSensor\_gym\_1,TemperatureSensor\_park\_1,TemperatureSensor\_kitchen\_1,TemperatureSensor\_receptionist\_1,TemperatureSensor\_canteen\_1,TemperatureSensor\_bath\_1 } **×** {On\_TemperatureSensor\_01,On\_TemperatureSensor\_02,On\_TemperatureSensor\_03,On\_TemperatureSensor\_04

On\_TemperatureSensor\_05,On\_TemperatureSensor\_06,On\_TemperatureSensor\_videosurveillanceroom\_1,On\_TemperatureSensor\_gym\_1,On\_TemperatureSensor\_kitchen\_1,On\_TemperatureSensor\_receptionist\_1,On\_TemperatureSensor\_canteen\_1,On\_TemperatureSensor\_bath\_1,Off\_TemperatureSensor\_01,Off\_TemperatureSensor\_02,Off\_TemperatureSensor\_03,Off\_TemperatureSensor\_04 ,Off\_TemperatureSensor\_05, Off\_TemperatureSensor\_06,Off\_TemperatureSensor\_videosurveillanceroom\_1 ,Off\_TemperatureSensor\_gym\_1, Off\_TemperatureSensor\_kitchen\_1,Off\_TemperatureSensor\_receptionist\_1,Off\_TemperatureSensor\_canteen\_1,Off\_TemperatureSensor\_bath\_1,Schedule\_TemperatureSensor\_01,Schedule\_TemperatureSensor\_02,Schedule\_TemperatureSensor\_03,Schedule\_TemperatureSensor\_04,Schedule\_TemperatureSensor\_05,Schedule\_TemperatureSensor\_06,Schedule\_TemperatureSensor\_videosurveillanceroom\_1,Schedule\_TemperatureSensor\_gym\_1,Schedule\_TemperatureSensor\_kitchen\_1,Schedule\_TemperatureSensor\_receptionist\_1,Schedule\_TemperatureSensor\_canteen\_1,Schedule\_TemperatureSensor\_bath\_1}

**Second building**

**P220=**{TemperatureSensor\_07,TemperatureSensor\_08,TemperatureSensor\_09,TemperatureSensor\_10,TemperatureSensor\_11,TemperatureSensor\_12,TemperatureSensor\_videosurveillanceroom\_2,TemperatureSensor\_gym\_2,TemperatureSensor\_park\_2,TemperatureSensor\_kitchen\_2,TemperatureSensor\_receptionist\_2,TemperatureSensor\_canteen\_2,TemperatureSensor\_bath\_2 } **×** {On\_TemperatureSensor\_07,On\_TemperatureSensor\_08,On\_TemperatureSensor\_09,On\_TemperatureSensor\_10

On\_TemperatureSensor\_11,On\_TemperatureSensor\_12,On\_TemperatureSensor\_videosurveillanceroom\_2,On\_TemperatureSensor\_gym\_2,On\_TemperatureSensor\_kitchen\_2,On\_TemperatureSensor\_receptionist\_2,On\_TemperatureSensor\_canteen\_2,On\_TemperatureSensor\_bath\_2,Off\_TemperatureSensor\_07,Off\_TemperatureSensor\_08,Off\_TemperatureSensor\_09,Off\_TemperatureSensor\_10 ,Off\_TemperatureSensor\_11,

Off\_TemperatureSensor\_12,Off\_TemperatureSensor\_videosurveillanceroom\_2 ,Off\_TemperatureSensor\_gym\_2, Off\_TemperatureSensor\_kitchen\_2,Off\_TemperatureSensor\_receptionist\_2,Off\_TemperatureSensor\_canteen\_2,Off\_TemperatureSensor\_bath\_2,Schedule\_TemperatureSensor\_07,Schedule\_TemperatureSensor\_08,Schedule\_TemperatureSensor\_09,Schedule\_TemperatureSensor\_10,Schedule\_TemperatureSensor\_11,Schedule\_TemperatureSensor\_12,Schedule\_TemperatureSensor\_videosurveillanceroom\_2,Schedule\_TemperatureSensor\_gym\_2,Schedule\_TemperatureSensor\_kitchen\_2,Schedule\_TemperatureSensor\_receptionist\_2,Schedule\_TemperatureSensor\_canteen\_2,Schedule\_TemperatureSensor\_bath\_2}

**Humidity Sensor**

**First building**

**P221=**{HumiditySensor\_01,HumiditySensor\_02,HumiditySensor\_03,HumiditySensor\_04,HumiditySensor\_05,HumiditySensor\_06,HumiditySensor\_videosurveillanceroom\_1,HumiditySensor\_gym\_1,HumiditySensor\_park\_1,HumiditySensor\_kitchen\_1,HumiditySensor\_receptionist\_1,HumiditySensor\_canteen\_1,HumiditySensor\_bath\_1 } **×** {On\_HumiditySensor\_01,On\_HumiditySensor\_02,On\_HumiditySensor\_03,On\_HumiditySensor\_04

On\_HumiditySensor\_05,On\_HumiditySensor\_06,On\_HumiditySensor\_videosurveillanceroom\_1,On\_HumiditySensor\_gym\_1,On\_HumiditySensor\_kitchen\_1,On\_HumiditySensor\_receptionist\_1,On\_HumiditySensor\_canteen\_1,On\_HumiditySensor\_bath\_1,Off\_HumiditySensor\_01,Off\_HumiditySensor\_02,Off\_HumiditySensor\_03,Off\_HumiditySensor\_04 ,Off\_HumiditySensor\_05, Off\_HumiditySensor\_06,Off\_HumiditySensor\_videosurveillanceroom\_1 ,Off\_HumiditySensor\_gym\_1, Off\_HumiditySensor\_kitchen\_1,Off\_HumiditySensor\_receptionist\_1,Off\_HumiditySensor\_canteen\_1,Off\_HumiditySensor\_bath\_1,Schedule\_HumiditySensor\_01,Schedule\_HumiditySensor\_02,Schedule\_HumiditySensor\_03,Schedule\_HumiditySensor\_04,Schedule\_HumiditySensor\_05,Schedule\_HumiditySensor\_06,Schedule\_HumiditySensor\_videosurveillanceroom\_1,Schedule\_HumiditySensor\_gym\_1,Schedule\_HumiditySensor\_kitchen\_1,Schedule\_HumiditySensor\_receptionist\_1,Schedule\_HumiditySensor\_canteen\_1,Schedule\_HumiditySensor\_bath\_1}

**Second building**

**P222=**{HumiditySensor\_07,HumiditySensor\_08,HumiditySensor\_09,HumiditySensor\_10,HumiditySensor\_11,HumiditySensor\_12,HumiditySensor\_videosurveillanceroom\_2,HumiditySensor\_gym\_2,HumiditySensor\_park\_2,HumiditySensor\_kitchen\_2,HumiditySensor\_receptionist\_2,HumiditySensor\_canteen\_2,HumiditySensor\_bath\_2 } **×** {On\_HumiditySensor\_07,On\_HumiditySensor\_08,On\_HumiditySensor\_09,On\_HumiditySensor\_10

On\_HumiditySensor\_11,On\_HumiditySensor\_12,On\_HumiditySensor\_videosurveillanceroom\_2,On\_HumiditySensor\_gym\_2,On\_HumiditySensor\_kitchen\_2,On\_HumiditySensor\_receptionist\_2,On\_HumiditySensor\_canteen\_2,On\_HumiditySensor\_bath\_2,Off\_HumiditySensor\_07,Off\_HumiditySensor\_08,Off\_HumiditySensor\_09,Off\_HumiditySensor\_10 ,Off\_HumiditySensor\_11,

Off\_HumiditySensor\_12,Off\_HumiditySensor\_videosurveillanceroom\_2 ,Off\_HumiditySensor\_gym\_2, Off\_HumiditySensor\_kitchen\_2,Off\_HumiditySensor\_receptionist\_2,Off\_HumiditySensor\_canteen\_2,Off\_HumiditySensor\_bath\_2,Schedule\_HumiditySensor\_07,Schedule\_HumiditySensor\_08,Schedule\_HumiditySensor\_09,Schedule\_HumiditySensor\_10,Schedule\_HumiditySensor\_11,Schedule\_HumiditySensor\_12,Schedule\_HumiditySensor\_videosurveillanceroom\_2,Schedule\_HumiditySensor\_gym\_2,Schedule\_HumiditySensor\_kitchen\_2,Schedule\_HumiditySensor\_receptionist\_2,Schedule\_HumiditySensor\_canteen\_2,Schedule\_HumiditySensor\_bath\_2}

**Occupancy sensor**

**First building**

**P223=**{OccupancySensor\_01,OccupancySensor\_02,OccupancySensor\_03,OccupancySensor\_04,OccupancySensor\_05,OccupancySensor\_06,OccupancySensor\_videosurveillanceroom\_1,OccupancySensor\_gym\_1,OccupancySensor\_park\_1,OccupancySensor\_kitchen\_1,OccupancySensor\_receptionist\_1,OccupancySensor\_canteen\_1,OccupancySensor\_bath\_1 } **×** {On\_OccupancySensor\_01,On\_OccupancySensor\_02,On\_OccupancySensor\_03,On\_OccupancySensor\_04

On\_OccupancySensor\_05,On\_OccupancySensor\_06,On\_OccupancySensor\_videosurveillanceroom\_1,On\_OccupancySensor\_gym\_1,On\_OccupancySensor\_kitchen\_1,On\_OccupancySensor\_receptionist\_1,On\_OccupancySensor\_canteen\_1,On\_OccupancySensor\_bath\_1,Off\_OccupancySensor\_01,Off\_OccupancySensor\_02,Off\_OccupancySensor\_03,Off\_OccupancySensor\_04 ,Off\_OccupancySensor\_05, Off\_OccupancySensor\_06,Off\_OccupancySensor\_videosurveillanceroom\_1 ,Off\_OccupancySensor\_gym\_1, Off\_OccupancySensor\_kitchen\_1,Off\_OccupancySensor\_receptionist\_1,Off\_OccupancySensor\_canteen\_1,Off\_OccupancySensor\_bath\_1,Schedule\_OccupancySensor\_01,Schedule\_OccupancySensor\_02,Schedule\_OccupancySensor\_03,Schedule\_OccupancySensor\_04,Schedule\_OccupancySensor\_05,Schedule\_OccupancySensor\_06,Schedule\_OccupancySensor\_videosurveillanceroom\_1,Schedule\_OccupancySensor\_gym\_1,Schedule\_OccupancySensor\_kitchen\_1,Schedule\_OccupancySensor\_receptionist\_1,Schedule\_OccupancySensor\_canteen\_1,Schedule\_OccupancySensor\_bath\_1}

**Second building**

**P224=**{OccupancySensor\_07,OccupancySensor\_08,OccupancySensor\_09,OccupancySensor\_10,OccupancySensor\_11,OccupancySensor\_12,OccupancySensor\_videosurveillanceroom\_2,OccupancySensor\_gym\_2,OccupancySensor\_park\_2,OccupancySensor\_kitchen\_2,OccupancySensor\_receptionist\_2,OccupancySensor\_canteen\_2,OccupancySensor\_bath\_2 } **×** {On\_OccupancySensor\_07,On\_OccupancySensor\_08,On\_OccupancySensor\_09,On\_OccupancySensor\_10

On\_OccupancySensor\_11,On\_OccupancySensor\_12,On\_OccupancySensor\_videosurveillanceroom\_2,On\_OccupancySensor\_gym\_2,On\_OccupancySensor\_kitchen\_2,On\_OccupancySensor\_receptionist\_2,On\_OccupancySensor\_canteen\_2,On\_OccupancySensor\_bath\_2,Off\_OccupancySensor\_07,Off\_OccupancySensor\_08,Off\_OccupancySensor\_09,Off\_OccupancySensor\_10 ,Off\_OccupancySensor\_11,

Off\_OccupancySensor\_12,Off\_OccupancySensor\_videosurveillanceroom\_2 ,Off\_OccupancySensor\_gym\_2, Off\_OccupancySensor\_kitchen\_2,Off\_OccupancySensor\_receptionist\_2,Off\_OccupancySensor\_canteen\_2,Off\_OccupancySensor\_bath\_2,Schedule\_OccupancySensor\_07,Schedule\_OccupancySensor\_08,Schedule\_OccupancySensor\_09,Schedule\_OccupancySensor\_10,Schedule\_OccupancySensor\_11,Schedule\_OccupancySensor\_12,Schedule\_OccupancySensor\_videosurveillanceroom\_2,Schedule\_OccupancySensor\_gym\_2,Schedule\_OccupancySensor\_kitchen\_2,Schedule\_OccupancySensor\_receptionist\_2,Schedule\_OccupancySensor\_canteen\_2,Schedule\_OccupancySensor\_bath\_2}

**Light sensor**

**First building**

**P225=**{LightSensor\_01,LightSensor\_02,LightSensor\_03,LightSensor\_04,LightSensor\_05,LightSensor\_06,LightSensor\_videosurveillanceroom\_1,LightSensor\_gym\_1,LightSensor\_park\_1,LightSensor\_kitchen\_1,LightSensor\_receptionist\_1,LightSensor\_canteen\_1,LightSensor\_bath\_1 } **×** {On\_LightSensor\_01,On\_LightSensor\_02,On\_LightSensor\_03,On\_LightSensor\_04

On\_LightSensor\_05,On\_LightSensor\_06,On\_LightSensor\_videosurveillanceroom\_1,On\_LightSensor\_gym\_1,On\_LightSensor\_kitchen\_1,On\_LightSensor\_receptionist\_1,On\_LightSensor\_canteen\_1,On\_LightSensor\_bath\_1,Off\_LightSensor\_01,Off\_LightSensor\_02,Off\_LightSensor\_03,Off\_LightSensor\_04 ,Off\_LightSensor\_05, Off\_LightSensor\_06,Off\_LightSensor\_videosurveillanceroom\_1 ,Off\_LightSensor\_gym\_1, Off\_LightSensor\_kitchen\_1,Off\_LightSensor\_receptionist\_1,Off\_LightSensor\_canteen\_1,Off\_LightSensor\_bath\_1,Schedule\_LightSensor\_01,Schedule\_LightSensor\_02,Schedule\_LightSensor\_03,Schedule\_LightSensor\_04,Schedule\_LightSensor\_05,Schedule\_LightSensor\_06,Schedule\_LightSensor\_videosurveillanceroom\_1,Schedule\_LightSensor\_gym\_1,Schedule\_LightSensor\_kitchen\_1,Schedule\_LightSensor\_receptionist\_1,Schedule\_LightSensor\_canteen\_1,Schedule\_LightSensor\_bath\_1}

**Second building**

**P226=**{LightSensor\_07,LightSensor\_08,LightSensor\_09,LightSensor\_10,LightSensor\_11,LightSensor\_12,LightSensor\_videosurveillanceroom\_2,LightSensor\_gym\_2,LightSensor\_park\_2,LightSensor\_kitchen\_2,LightSensor\_receptionist\_2,LightSensor\_canteen\_2,LightSensor\_bath\_2 } **×** {On\_LightSensor\_07,On\_LightSensor\_08,On\_LightSensor\_09,On\_LightSensor\_10

On\_LightSensor\_11,On\_LightSensor\_12,On\_LightSensor\_videosurveillanceroom\_2,On\_LightSensor\_gym\_2,On\_LightSensor\_kitchen\_2,On\_LightSensor\_receptionist\_2,On\_LightSensor\_canteen\_2,On\_LightSensor\_bath\_2,Off\_LightSensor\_07,Off\_LightSensor\_08,Off\_LightSensor\_09,Off\_LightSensor\_10 ,Off\_LightSensor\_11,

Off\_LightSensor\_12,Off\_LightSensor\_videosurveillanceroom\_2 ,Off\_LightSensor\_gym\_2, Off\_LightSensor\_kitchen\_2,Off\_LightSensor\_receptionist\_2,Off\_LightSensor\_canteen\_2,Off\_LightSensor\_bath\_2,Schedule\_LightSensor\_07,Schedule\_LightSensor\_08,Schedule\_LightSensor\_09,Schedule\_LightSensor\_10,Schedule\_LightSensor\_11,Schedule\_LightSensor\_12,Schedule\_LightSensor\_videosurveillanceroom\_2,Schedule\_LightSensor\_gym\_2,Schedule\_LightSensor\_kitchen\_2,Schedule\_LightSensor\_receptionist\_2,Schedule\_LightSensor\_canteen\_2,Schedule\_LightSensor\_bath\_2}

**HMI**

**First building**

**P227**={HMI\_01,HMI\_02,HMI\_03,HMI\_04,HMI\_05,HMI\_06,HMI\_videosurveillanceroom\_1,HMI\_gym\_1,HMI\_park\_1,HMI\_kitchen\_1,HMI\_receptionist\_1,HMI\_canteen\_1,HMI\_bath\_1 } ×

{On\_HMI\_01,On\_HMI\_02,On\_HMI\_03,On\_HMI\_04,On\_HMI\_05,On\_HMI\_06,On\_HMI\_videosurveillanceroom\_1,On\_HMI\_gym\_1,On\_HMI\_kitchen\_1,On\_HMI\_receptionist\_1,On\_HMI\_canteen\_1,On\_HMI\_bath\_1,Off\_HMI\_01,Off\_HMI\_02,Off\_HMI\_03,Off\_HMI\_04 ,Off\_HMI\_05, Off\_HMI\_06,Off\_HMI\_videosurveillanceroom\_1 ,Off\_HMI\_gym\_1, Off\_HMI\_kitchen\_1,Off\_HMI\_receptionist\_1,Off\_HMI\_canteen\_1,Off\_HMI\_bath\_1,Display\_HMI\_01,Display\_HMI\_02,Display\_HMI\_03,Display\_HMI\_04,Display\_HMI\_05,Display\_HMI\_06,Display\_HMI\_videosurveillanceroom\_1,Display\_HMI\_gym\_1,Display\_HMI\_kitchen\_1,Display\_HMI\_receptionist\_1,Display\_HMI\_canteen\_1,Display\_HMI\_bath\_1, Status\_HMI\_01,Status\_HMI\_02,Status\_HMI\_03,Status\_HMI\_04,Status\_HMI\_05,Status\_HMI\_06,Status\_HMI\_videosurveillanceroom\_1,Status\_HMI\_gym\_1,Status\_HMI\_kitchen\_1,Status\_HMI\_receptionist\_1,Status\_HMI\_canteen\_1,Status\_HMI\_bath\_1}

**Second building**

**P228**={HMI\_07,HMI\_08,HMI\_09,HMI\_10,HMI\_11,HMI\_12,HMI\_videosurveillanceroom\_2,HMI\_gym\_2,HMI\_park\_2,HMI\_kitchen\_2,HMI\_receptionist\_2,HMI\_canteen\_2,HMI\_bath\_2 } ×

{On\_HMI\_07,On\_HMI\_08,On\_HMI\_09,On\_HMI\_10,On\_HMI\_11,On\_HMI\_12,On\_HMI\_videosurveillanceroom\_2,On\_HMI\_gym\_2,On\_HMI\_kitchen\_2,On\_HMI\_receptionist\_2,On\_HMI\_canteen\_2,On\_HMI\_bath\_2,Off\_HMI\_07,Off\_HMI\_08,Off\_HMI\_09,Off\_HMI\_10 ,Off\_HMI\_11,

Off\_HMI\_12,Off\_HMI\_videosurveillanceroom\_2 ,Off\_HMI\_gym\_2, Off\_HMI\_kitchen\_2,Off\_HMI\_receptionist\_2,Off\_HMI\_canteen\_2,Off\_HMI\_bath\_2,Display\_HMI\_07,Display\_HMI\_08,Display\_HMI\_09,Display\_HMI\_10,Display\_HMI\_11,Display\_HMI\_12,Display\_HMI\_videosurveillanceroom\_2,Display\_HMI\_gym\_2,Display\_HMI\_kitchen\_2,Display\_HMI\_receptionist\_2,Display\_HMI\_canteen\_2,Display\_HMI\_bath\_2, Status\_HMI\_07,Status\_HMI\_08,Status\_HMI\_09,Status\_HMI\_10,Status\_HMI\_11,Status\_HMI\_12,Status\_HMI\_videosurveillanceroom\_2,Status\_HMI\_gym\_2,Status\_HMI\_kitchen\_2,Status\_HMI\_receptionist\_2,Status\_HMI\_canteen\_2,Status\_HMI\_bath\_2}

**PMI**

**First building**

**P229=**{PMI\_01,PMI\_02,PMI\_03,PMI\_04,PMI\_05,PMI\_06,PMI\_videosurveillanceroom\_1,PMI\_gym\_1,PMI\_park\_1,PMI\_kitchen\_1,PMI\_receptionist\_1,PMI\_canteen\_1,PMI\_bath\_1 } **×** {On\_PMI\_01,On\_PMI\_02,On\_PMI\_03,On\_PMI\_04

On\_PMI\_05,On\_PMI\_06,On\_PMI\_videosurveillanceroom\_1,On\_PMI\_gym\_1,On\_PMI\_kitchen\_1,On\_PMI\_receptionist\_1,On\_PMI\_canteen\_1,On\_PMI\_bath\_1,Off\_PMI\_01,Off\_PMI\_02,Off\_PMI\_03,Off\_PMI\_04 ,Off\_PMI\_05, Off\_PMI\_06,Off\_PMI\_videosurveillanceroom\_1 ,Off\_PMI\_gym\_1, Off\_PMI\_kitchen\_1,Off\_PMI\_receptionist\_1,Off\_PMI\_canteen\_1,Off\_PMI\_bath\_1,Monitor\_PMI\_01,Monitor\_PMI\_02,Monitor\_PMI\_03,Monitor\_PMI\_04,Monitor\_PMI\_05,Monitor\_PMI\_06,Monitor\_PMI\_videosurveillanceroom\_1,Monitor\_PMI\_gym\_1,Monitor\_PMI\_kitchen\_1,Monitor\_PMI\_receptionist\_1,Monitor\_PMI\_canteen\_1,Monitor\_PMI\_bath\_1, Manage\_PMI\_01,Manage\_PMI\_02,Manage\_PMI\_03,Manage\_PMI\_04,Manage\_PMI\_05,Manage\_PMI\_06,Manage\_PMI\_videosurveillanceroom\_1,Manage\_PMI\_gym\_1,Manage\_PMI\_kitchen\_1,Manage\_PMI\_receptionist\_1,Manage\_PMI\_canteen\_1,Manage\_PMI\_bath\_1}

**Second building**

**P230=**{PMI\_07,PMI\_08,PMI\_09,PMI\_10,PMI\_11,PMI\_12,PMI\_videosurveillanceroom\_2,PMI\_gym\_2,PMI\_park\_2,PMI\_kitchen\_2,PMI\_receptionist\_2,PMI\_canteen\_2,PMI\_bath\_2 } **×** {On\_PMI\_07,On\_PMI\_08,On\_PMI\_09,On\_PMI\_10

On\_PMI\_11,On\_PMI\_12,On\_PMI\_videosurveillanceroom\_2,On\_PMI\_gym\_2,On\_PMI\_kitchen\_2,On\_PMI\_receptionist\_2,On\_PMI\_canteen\_2,On\_PMI\_bath\_2,Off\_PMI\_07,Off\_PMI\_08,Off\_PMI\_09,Off\_PMI\_10 ,Off\_PMI\_11,

Off\_PMI\_12,Off\_PMI\_videosurveillanceroom\_2 ,Off\_PMI\_gym\_2, Off\_PMI\_kitchen\_2,Off\_PMI\_receptionist\_2,Off\_PMI\_canteen\_2,Off\_PMI\_bath\_2,Monitor\_PMI\_07,Monitor\_PMI\_08,Monitor\_PMI\_09,Monitor\_PMI\_10,Monitor\_PMI\_11,Monitor\_PMI\_12,Monitor\_PMI\_videosurveillanceroom\_2,Monitor\_PMI\_gym\_2,Monitor\_PMI\_kitchen\_2,Monitor\_PMI\_receptionist\_2,Monitor\_PMI\_canteen\_2,Monitor\_PMI\_bath\_2, Manage\_PMI\_07,Manage\_PMI\_08,Manage\_PMI\_09,Manage\_PMI\_10,Manage\_PMI\_11,Manage\_PMI\_12,Manage\_PMI\_videosurveillanceroom\_2,Manage\_PMI\_gym\_2,Manage\_PMI\_kitchen\_2,Manage\_PMI\_receptionist\_2,Manage\_PMI\_canteen\_2,Manage\_PMI\_bath\_2}

**HVAC\_DEVICES**

Permissions for HVAC in different smart buildings have been defined.

**SMART HEAT PUMP**

**First building**

**P231**={ SmartHeatPump\_06} x {On\_ SmartHeatPump\_06, off\_SmartHeatPump\_06, display\_SmartHeatPump\_06}

**Secondo building**

**P232**={ SmartHeatPump\_12} x {On\_ SmartHeatPump\_12, off\_SmartHeatPump\_12, display\_SmartHeatPump\_12}

**HVAC\_CONTROLLERS**

**First building**

**P233**={ HvacControllers\_serverRoom\_1} x { On\_HvacControllers\_serverRoom\_1

, Off\_HvacControllers\_serverRoom\_1, Setup\_HvacControllers\_serverRoom\_1}

**Secondo building**

**P234**={ HvacControllers\_serverRoom\_2} x { On\_HvacControllers\_serverRoom\_2

, Off\_HvacControllers\_serverRoom\_2, Setup\_HvacControllers\_serverRoom\_2}

**SMART\_AIR\_PURIFIER**

**First building**

**P235**={ SmartAirPurifier\_06} x { On\_ SmartAirPurifier\_06,

Off\_SmartAirPurifier\_06, display\_ SmartAirPurifier\_06}

**Second building**

**P236**={ SmartAirPurifier\_12} x { On\_ SmartAirPurifier\_12,

Off\_SmartAirPurifier\_12, display\_ SmartAirPurifier\_12}

**CTO\_Private\_pc**

**P237** = {Pc\_CTO} x { On\_Pc\_CTO ,Off\_Pc\_CTO}

**Environmental\_data\_storage**

**P238** = {pc\_01} x{On\_Pc\_01,Off\_Pc\_01}

**Monitoring\_energy\_resources**

**P239** = {pc\_69} x {On\_Pc\_69, Off\_Pc\_69}

**P =**

In the section below, permissions are associated with each defined DR.

For example, in security\_device are the following: video surveillance cameras,

smoke alarms, burglar alarms, video surveillance monitors, and the PCs of the

CEO, RPS, and vigilantes.

Or in work\_device are the computers of employees, receptionists, and Alexa.

**PDRA= {** {{P29 U P30}× **Entertainment\_Device**} U {{P1 U P2 U P3 U P4 U P5 U P6 U P7 U

P8 U P9 U P10 U P11 U P12 U P13 U P14} × **Door\_Device** } U {P33 U P34 U P213 P214 ×

**Advanced\_Device**} U {P39 U P40 × **Safe\_Device**} U {P61 … U P117 U P125 U P126 U P129 … U

P185 U P193 U P194 × **Computer\_Device**} U {{P195 U P196 U P197 U P198 P199 U P200 U P201 U

P202} × **Tablet\_Device**} U {{P203 U P204} × **Fitness\_Device**} U {{P195 U P199} ×

**Fitness\_PT\_Device**} U {{P209 U P210} x **Garage\_Device**} U {{P205 U P206} x **Wifi\_Device**}

U {{P55 U P56 U P197 U P201 U P198 U P202} × **Kitchen\_Device**} U {{P41 U P42 U P43 U P44 U

P48 U P49 U P50 U P51}x **Monitor\_Device**} U {P31 U P32 U P35 U P36 U P37 U P38 U P45 U

P46 U P47 U P52 U P53 U P54 U P118… U P124 U P186… U P192 UP59 UP60 UP127 UP128 x

**Security\_Device**} U {P15 U P16 U P17 U P18 U P19 U P20 U P21 U P22 U P23 U P24 U P25 U P26 U

P27 U P28 × **Lighting\_Device**} {{P57 U P58}× **Cleaning\_Device**} U {{P61 … U

P117 U P125 U P126 UP129 … U P185 U P193 U P194 U P29 U P30}× **Work\_Device**} U {{P7 U P14 U

P21 U P28 U P211 U P212 U P207 U P208}× **Common\_Device**} U {P215 U P217}×**Biometric\_Device**} U { P21 U P218}x **Biometric\_Controlled**} U {{P219… U P230} x **BMS\_DEVICES} U {{** P231… U P236}x **HVAC\_DEVICES}** U {{P237} x **CTO\_Private\_pc} U** {P238}x **Environmental\_data\_storage**} **U** {P239} x **Monitoring\_energy\_resources**}**}**

Environment Roles (ER) represent environmental contexts, such as daytime/nighttime, and winter/summer. Environment roles are triggered by Environment Conditions (EC) such as daylight, or weather. EA maps each environment role to a subset of EC.

**EC** = { working\_days, morning, evening, weekends, emergency}

**ER** = { Not\_At\_office, Any\_Time, At\_office, Emergency\_Time}

**EA** = {({weekends, evenings}, Not\_At\_office), ({TRUE}, Any\_Time),({emergency}, Emergency\_Time), ({working\_days, morning}, At\_office)}

Each role pair is a combination of a role and currently active environment roles. A role pair rp has a role part rp.r that is the single role associated with rp, and an environment role part rp.ER.

**RP** = {

CTO ANY TIME

**First building**

(CTO, {Any\_Time)),(CEO\_1,{ Any\_Time}), ( CEO\_1,{ Not\_At\_office}), ( CEO\_1,{ Emergency\_Time}),{(RPS\_1,{ Any\_Time}),( RPS\_1,{Emergency\_Time}),( RPS\_1,{ Not\_At\_office}), (ITE\_Manager\_1,{At\_office}),(NC\_Engineer\_1,{At\_office}),(ES\_Engineer\_1,{ At\_office}),(IT\_1,{ At\_office}),( HR\_Manager\_1,{ At\_office}),(Adm\_empl\_1,{ At\_office}),(Receptionist\_1,{ At\_office}),(Waiter\_1,{ At\_office}),(PT,{ At\_office}),(Gym\_client\_1,{ At\_office}),(Chef\_1,{ At\_office}),(Guest\_1,{ At\_office}),(Cleaner\_1,{At\_office}),(Vigilant\_1,{At\_office}),(Vigilant\_1,{ Not\_At\_office}),(Vigilant\_1,{ Emergency\_Time}, (Vigilant\_1,{ Any\_Time})

**Second building**

( CEO\_2,{ Any\_Time}), ( CEO\_2,{ Not\_At\_office}), ( CEO\_2,{ Emergency\_Time}),

{( RPS\_2,{ Any\_Time}),( RPS\_2,{Emergency\_Time}),( RPS\_2,{ Not\_At\_office}),

( ITE\_Manager\_2,{ At\_office}), ( NC\_Engineer\_2,{At\_office}),(ES\_Engineer\_2,{ At\_office}),(IT\_2,{ At\_office}),( HR\_Manager\_2,{ At\_office}),(Adm\_empl\_2,{ At\_office}),(Receptionist\_2,{ At\_office}),(Waiter\_2,{ At\_office}),(PT,{ At\_office}),(Gym\_client\_2,{ At\_office}),(Chef\_2,{ At\_office}),(Guest\_2,{ At\_office}),(Cleaner\_2,{At\_office}),(Vigilant\_2,{At\_office}),(Vigilant\_2,{ Not\_At\_office}),(Vigilant\_2,{ Emergency\_Time}, (Vigilant\_2,{ Any\_Time})

}

RPDRA, combining all of these elements together, assigns device roles to role pairs.

**RPDRA** = { ((CTO, {Any\_Time}), **CTO\_Private\_pc),**

((CTO, {Any\_Time}), BMS\_devices),

((CTO, {Any\_Time}), HVAC\_devices),

((CTO,{Any\_Time}),Door\_Device),

(CEO\_1,{Any\_Time}),Entertainment\_Device),

((CEO\_1,{Any\_Time}),Door\_Device),

((CEO\_1,{Any\_Time}),Advanced\_Device),

((CEO\_1,{Any\_Time}),Safe\_Device),

((CEO\_1,{Any\_Time}),Computer\_Device),

((CEO\_1,{Any\_Time}),Tablet\_Device),

((CEO\_1,{Any\_Time}),Fitness\_Device),

((CEO\_1,{Any\_Time}),Garage\_Device),

((CEO\_1,{Any\_Time}),Wifi\_Device),

((CEO\_1,{Any\_Time}),Monitor\_Device),

((CEO\_1,{Any\_Time}),Security\_Device),

((CEO\_1,{Any\_Time}),Lighting\_Device),

((CEO\_1,{Any\_Time}),Work\_Device),

((CEO\_1,{Any\_Time}),Common\_Device),

((CEO\_1,{Any\_Time}),Security\_Device),

((CEO\_1,{Any\_Time}),Biometric\_Controlled),

((CEO\_1,{Emergency\_Time}),kitchen\_Device),

((CEO\_2,{Any\_Time}),Entertainment\_Device),

((CEO\_2,{Any\_Time}),Door\_Device),

((CEO\_2,{Any\_Time}),Advanced\_Device),

((CEO\_2,{Any\_Time}),Safe\_Device),

((CEO\_2,{Any\_Time}),Computer\_Device),

((CEO\_2,{Any\_Time}),Tablet\_Device),

((CEO\_2,{Any\_Time}),Fitness\_Device),

((CEO\_2,{Any\_Time}),Garage\_Device),

((CEO\_2,{Any\_Time}),Wifi\_Device),

((CEO\_2,{Any\_Time}),Monitor\_Device),

((CEO\_2,{Any\_Time}),Security\_Device),

((CEO\_2,{Any\_Time}),Lighting\_Device),

((CEO\_2,{Any\_Time}),Work\_Device),

((CEO\_2,{Any\_Time}),Common\_Device),

((CEO\_2,{Any\_Time}),Security\_Device),

((CEO\_2,{Any\_Time}),Biometric\_Controlled),

((CEO\_2,{Emergency\_Time}),kitchen\_Device),

((RPS\_1,{Any\_Time}),Entertainment\_Device),

((RPS\_1,{Any\_Time}),Cleaning\_Device),

((RPS\_1,{Any\_Time}), Advanced\_Device),

((RPS\_1,{Emergency\_Time}),Safe\_Device),

((RPS\_1,{Any\_Time}),Door\_Device),

((RPS\_1,{Any\_Time}),Computer\_Device),

((RPS\_1,{Any\_Time}),Tablet\_Device),

((RPS\_1,{Any\_Time}),Fitness\_Device),

((RPS\_1,{ Emergency\_Time}),Fitness\_PT\_Device),

((RPS\_1,{Any\_Time}),Garage\_Device),

((RPS\_1,{Any\_Time}),Wifi\_Device),

((RPS\_1,{Emergency\_Time}),kitchen\_Device),

((RPS\_1,{Any\_Time}),Monitor\_Device),

((RPS\_1,{Any\_Time}),Security\_Device),

((RPS\_1,{Any\_Time}),Lighting\_Device),

((RPS\_1,{Emergency\_Time}),Cleaning\_Device),

((RPS\_1,{Any\_Time}),Work\_Device),

((RPS\_1,{Any\_Time}),Common\_Device),

((RPS\_1,{Emergency\_Time}),Biometric\_Device),

((RPS\_2,{Any\_Time}),Entertainment\_Device),

((RPS\_2,{Any\_Time}),Cleaning\_Device),

((RPS\_2,{Any\_Time}), Advanced\_Device),

((RPS\_2,{Emergency\_Time}),Safe\_Device),

((RPS\_2,{Any\_Time}),Door\_Device),

((RPS\_2,{Any\_Time}),Computer\_Device),

((RPS\_2,{Any\_Time}),Tablet\_Device),

((RPS\_2,{Any\_Time}),Fitness\_Device),

((RPS\_2,{ Emergency\_Time}),Fitness\_PT\_Device),

((RPS\_2,{Any\_Time}),Garage\_Device),

((RPS\_2,{Any\_Time}),Wifi\_Device),

((RPS\_2,{Emergency\_Time}),kitchen\_Device),

((RPS\_2,{Any\_Time}),Monitor\_Device),

((RPS\_2,{Any\_Time}),Security\_Device),

((RPS\_2,{Any\_Time}),Lighting\_Device),

((RPS\_2,{Emergency\_Time}),Cleaning\_Device),

((RPS\_2,{Any\_Time}),Work\_Device),

((RPS\_2,{Any\_Time}),Common\_Device),

((RPS\_2,{Emergency\_Time}),Biometric\_Device),

((ITE\_manager\_1,{At\_office}),Entertainment\_Device),

((ITE\_manager\_1,{At\_office}),Door\_Device),

((ITE\_manager\_1,{At\_office}),Computer\_Device),

((ITE\_manager\_1,{At\_office}),Tablet\_Device),

((ITE\_manager\_1,{At\_office}),Fitness\_Device),

((ITE\_manager\_1,{At\_office}),Garage\_Device),

((ITE\_manager\_1,{At\_office}),Wifi \_Device),

((ITE\_manager\_1,{At\_office}),Lighting\_Device),

((ITE\_manager\_1,{At\_office}),Work \_Device),

((ITE\_manager\_1,{At\_office}),Common\_Device),

((ITE\_manager\_2,{At\_office}),Entertainment\_Device),

((ITE\_manager\_2,{At\_office}),Door\_Device),

((ITE\_manager\_2,{At\_office}),Computer\_Device),

((ITE\_manager\_2,{At\_office}),Tablet\_Device),

((ITE\_manager\_2,{At\_office}),Fitness\_Device),

((ITE\_manager\_2,{At\_office}),Garage\_Device),

((ITE\_manager\_2,{At\_office}),Wifi \_Device),

((ITE\_manager\_2,{At\_office}),Lighting\_Device),

((ITE\_manager\_2,{At\_office}),Work \_Device),

((ITE\_manager\_2,{At\_office}),Common\_Device),

((NC\_Engineer\_1,{At\_office}),Entertainment\_Device}

((NC\_Engineer\_1,{At\_office}),Door\_Device}

((NC\_Engineer\_1,{At\_office}),Computer\_Device}

((NC\_Engineer\_1,{At\_office}),Tablet\_Device}

((NC\_Engineer\_1,{At\_office}),Fitness\_Device}

((NC\_Engineer\_1,{At\_office}),Garage\_Device}

((NC\_Engineer\_1,{At\_office}),Wifi\_Device}

((NC\_Engineer\_1,{At\_office}),Lighting\_Device}

((NC\_Engineer\_1,{At\_office}),Work\_Device}

((NC\_Engineer\_1,{At\_office}),Common\_Device}

((NC\_Engineer\_2,{At\_office}),Entertainment\_Device}

((NC\_Engineer\_2,{At\_office}),Door\_Device}

((NC\_Engineer\_2,{At\_office}),Computer\_Device}

((NC\_Engineer\_2,{At\_office}),Tablet\_Device}

((NC\_Engineer\_2,{At\_office}),Fitness\_Device}

((NC\_Engineer\_2,{At\_office}),Garage\_Device}

((NC\_Engineer\_2,{At\_office}),Wifi\_Device}

((NC\_Engineer\_2,{At\_office}),Lighting\_Device}

((NC\_Engineer\_2,{At\_office}),Work\_Device}

((NC\_Engineer\_2,{At\_office}),Common\_Device}

((ES\_Engineer\_1,{At\_office}),Entertainment\_Device}

((ES\_Engineer\_1,{At\_office}),Door\_Device}

((ES\_Engineer\_1,{At\_office}),Computer\_Device}

((ES\_Engineer\_1,{At\_office}),Tablet\_Device}

((ES\_Engineer\_1,{At\_office}),Fitness\_Device}

((ES\_Engineer\_1,{At\_office}),Garage\_Device}

((ES\_Engineer\_1,{At\_office}),Wifi\_Device}

((ES\_Engineer\_1,{At\_office}),Lighting\_Device}

((ES\_Engineer\_1,{At\_office}),Work\_Device}

((ES\_Engineer\_1,{At\_office}),Common\_Device}

((ES\_Engineer\_2,{At\_office}),Entertainment\_Device}

((ES\_Engineer\_2,{At\_office}),Door\_Device}

((ES\_Engineer\_2,{At\_office}),Computer\_Device}

((ES\_Engineer\_2,{At\_office}),Tablet\_Device}

((ES\_Engineer\_2,{At\_office}),Fitness\_Device}

((ES\_Engineer\_2,{At\_office}),Garage\_Device}

((ES\_Engineer\_2,{At\_office}),Wifi\_Device}

((ES\_Engineer\_2,{At\_office}),Lighting\_Device}

((ES\_Engineer\_2,{At\_office}),Work\_Device}

((ES\_Engineer\_2,{At\_office}),Common\_Device}

((IT\_1,{At\_office}),Entertainment\_Device}

((IT\_1,{At\_office}),Door\_Device}

((IT\_1,{At\_office}),Computer\_Device}

((IT\_1,{At\_office}),Tablet\_Device}

((IT\_1,{At\_office}),Fitness\_Device}

((IT\_1,{At\_office}),Garage\_Device}

((IT\_1,{At\_office}),Wifi\_Device}

((IT\_1,{At\_office}),Lighting\_Device}

((IT\_1,{At\_office}),Work\_Device}

((IT\_1,{At\_office}),Common\_Device}

((IT\_2,{At\_office}),Entertainment\_Device}

((IT\_2,{At\_office}),Door\_Device}

((IT\_2,{At\_office}),Computer\_Device}

((IT\_2,{At\_office}),Tablet\_Device}

((IT\_2,{At\_office}),Fitness\_Device}

((IT\_2,{At\_office}),Garage\_Device}

((IT\_2,{At\_office}),Wifi\_Device}

((IT\_2,{At\_office}),Lighting\_Device}

((IT\_2,{At\_office}),Work\_Device}

((IT\_2,{At\_office}),Common\_Device}

((HR\_Manager\_1,{At\_office}),Entertainment\_Device}

((HR\_Manager\_1,{At\_office}),Door\_Device}

((HR\_Manager\_1,{At\_office}),Safe\_Device}

((HR\_Manager\_1,{At\_office}),Computer\_Device}

((HR\_Manager\_1,{At\_office}),Tablet\_Device}

((HR\_Manager\_1,{At\_office}),Fitness\_Device}

((HR\_Manager\_1,{At\_office}),Garage\_Device}

((HR\_Manager\_1,{At\_office}),Wifi\_Device}

((HR\_Manager\_1,{At\_office}),Lighting\_Device}

((HR\_Manager\_1,{At\_office}),Work\_Device}

((HR\_Manager\_1,{At\_office}),Common\_Device}

((HR\_Manager\_1,{At\_office}),Biometric\_Device}

((HR\_Manager\_2,{At\_office}),Entertainment\_Device}

((HR\_Manager\_2,{At\_office}),Door\_Device}

((HR\_Manager\_2,{At\_office}),Safe\_Device}

((HR\_Manager\_2,{At\_office}),Computer\_Device}

((HR\_Manager\_2,{At\_office}),Tablet\_Device}

((HR\_Manager\_2,{At\_office}),Fitness\_Device}

((HR\_Manager\_2,{At\_office}),Garage\_Device}

((HR\_Manager\_2,{At\_office}),Wifi\_Device}

((HR\_Manager\_2,{At\_office}),Lighting\_Device}

((HR\_Manager\_2,{At\_office}),Work\_Device}

((HR\_Manager\_2,{At\_office}),Common\_Device}

((HR\_Manager\_2,{At\_office}),Biometric\_Device}

((Adm\_empl\_1,{At\_office}),Entertainment\_Device}

((Adm\_empl\_1,{At\_office}),Door\_Device}

((Adm\_empl\_1,{At\_office}),Safe\_Device}

((Adm\_empl\_1,{At\_office}),Computer\_Device}

((Adm\_empl\_1,{At\_office}),Tablet\_Device}

((Adm\_empl\_1,{At\_office}),Fitness\_Device}

((Adm\_empl\_1,{At\_office}),Garage\_Device}

((Adm\_empl\_1,{At\_office}),Wifi\_Device}

((Adm\_empl\_1,{At\_office}),Lighting\_Device}

((Adm\_empl\_1,{At\_office}),Work\_Device}

((Adm\_empl\_1,{At\_office}),Common\_Device}

((Adm\_empl\_1,{At\_office}),Biometric\_Device}

((Adm\_empl\_2,{At\_office}),Entertainment\_Device}

((Adm\_empl\_2,{At\_office}),Door\_Device}

((Adm\_empl\_2,{At\_office}),Safe\_Device}

((Adm\_empl\_2,{At\_office}),Computer\_Device}

((Adm\_empl\_2,{At\_office}),Tablet\_Device}

((Adm\_empl\_2,{At\_office}),Fitness\_Device}

((Adm\_empl\_2,{At\_office}),Garage\_Device}

((Adm\_empl\_2,{At\_office}),Wifi\_Device}

((Adm\_empl\_2,{At\_office}),Lighting\_Device}

((Adm\_empl\_2,{At\_office}),Work\_Device}

((Adm\_empl\_2,{At\_office}),Common\_Device}

((Adm\_empl\_2,{At\_office}),Biometric\_Device}

((Receptionist\_1,{At\_office}),Entertainment\_Device}

((Receptionist\_1,{At\_office}),Door\_Device}

((Receptionist\_1,{At\_office}),Computer\_Device}

((Receptionist\_1,{At\_office}),Tablet\_Device}

((Receptionist\_1,{At\_office}),Fitness\_Device}

((Receptionist\_1,{At\_office}),Garage\_Device}

((Receptionist\_1,{At\_office}),Wifi\_Device}

((Receptionist\_1,{At\_office}),Lighting\_Device}

((Receptionist\_1,{At\_office}),Work\_Device}

((Receptionist\_1,{At\_office}),Common\_Device}

((Receptionist\_1,{At\_office}),Monitor\_Device}

((Receptionist\_2,{At\_office}),Entertainment\_Device}

((Receptionist\_2,{At\_office}),Door\_Device}

((Receptionist\_2,{At\_office}),Computer\_Device}

((Receptionist\_2,{At\_office}),Tablet\_Device}

((Receptionist\_2,{At\_office}),Fitness\_Device}

((Receptionist\_2,{At\_office}),Garage\_Device}

((Receptionist\_2,{At\_office}),Wifi\_Device}

((Receptionist\_2,{At\_office}),Lighting\_Device}

((Receptionist\_2,{At\_office}),Work\_Device}

((Receptionist\_2,{At\_office}),Common\_Device}

((Receptionist\_2,{At\_office}),Monitor\_Device}

((Waiter\_1,{At\_office}),Door\_Device}

((Waiter\_1,{At\_office}),Tablet\_Device}

((Waiter\_1,{At\_office}),Fitness\_Device}

((Waiter\_1,{At\_office}),Garage\_Device}

((Waiter\_1,{At\_office}),Wifi\_Device}

((Waiter\_1,{At\_office}),Lighting\_Device}

((Waiter\_1,{At\_office}),Common\_Device}

((Waiter\_1,{At\_office}),Monitor\_Device}

((Waiter\_1,{At\_office}),Kitchen\_Device}

((Waiter\_2,{At\_office}),Door\_Device}

((Waiter\_2,{At\_office}),Tablet\_Device}

((Waiter\_2,{At\_office}),Fitness\_Device}

((Waiter\_2,{At\_office}),Garage\_Device}

((Waiter\_2,{At\_office}),Wifi\_Device}

((Waiter\_2,{At\_office}),Lighting\_Device}

((Waiter\_2,{At\_office}),Common\_Device}

((Waiter\_2,{At\_office}),Monitor\_Device}

((Waiter\_2,{At\_office}),Kitchen\_Device}

((PT\_1,{At\_office}),Door\_Device}

((PT\_1,{At\_office}),Tablet\_Device}

((PT\_1,{At\_office}),Fitness\_Device}

((PT\_1,{At\_office}),Fitness\_PT\_Device}

((PT\_1,{At\_office}),Garage\_Device}

((PT\_1,{At\_office}),Wifi\_Device}

((PT\_1,{At\_office}),Lighting\_Device}

((PT\_1,{At\_office}),Common\_Device}

((PT\_1,{At\_office}),Monitor\_Device}

((PT\_2,{At\_office}),Door\_Device}

((PT\_2,{At\_office}),Tablet\_Device}

((PT\_2,{At\_office}),Fitness\_Device}

((PT\_2,{At\_office}),Fitness\_PT\_Device}

((PT\_2,{At\_office}),Garage\_Device}

((PT\_2,{At\_office}),Wifi\_Device}

((PT\_2,{At\_office}),Lighting\_Device}

((PT\_2,{At\_office}),Common\_Device}

((PT\_2,{At\_office}),Monitor\_Device}

((Gym\_client\_1,{At\_office}),Door\_Device}

((Gym\_client\_1,{At\_office}),Tablet\_Device}

((Gym\_client\_1,{At\_office}),Fitness\_Device}

((Gym\_client\_1,{At\_office}),Garage\_Device}

((Gym\_client\_1,{At\_office}),Wifi\_Device}

((Gym\_client\_1,{At\_office}),Lighting\_Device}

((Gym\_client\_1,{At\_office}),Common\_Device}

((Gym\_client\_2,{At\_office}),Door\_Device}

((Gym\_client\_2,{At\_office}),Tablet\_Device}

((Gym\_client\_2,{At\_office}),Fitness\_Device}

((Gym\_client\_2,{At\_office}),Garage\_Device}

((Gym\_client\_2,{At\_office}),Wifi\_Device}

((Gym\_client\_2,{At\_office}),Lighting\_Device}

((Gym\_client\_2,{At\_office}),Common\_Device}

((Chef\_1,{At\_office}),Kitchen\_Device}

((Chef\_1,{At\_office}),Door\_Device}

((Chef\_1,{At\_office}),Tablet\_Device}

((Chef\_1,{At\_office}),Fitness\_Device}

((Chef\_1,{At\_office}),Garage\_Device}

((Chef\_1,{At\_office}),Wifi\_Device}

((Chef\_1,{At\_office}),Lighting\_Device}

((Chef\_1,{At\_office}),Common\_Device}

((Chef\_1,{At\_office}),Monitor\_Device}

((Chef\_2,{At\_office}),Kitchen\_Device}

((Chef\_2,{At\_office}),Door\_Device}

((Chef\_2,{At\_office}),Tablet\_Device}

((Chef\_2,{At\_office}),Fitness\_Device}

((Chef\_2,{At\_office}),Garage\_Device}

((Chef\_2,{At\_office}),Wifi\_Device}

((Chef\_2,{At\_office}),Lighting\_Device}

((Chef\_2,{At\_office}),Common\_Device}

((Chef\_2,{At\_office}),Monitor\_Device}

((Guest\_1,{At\_office}),Common\_Device}

((Guest\_2,{At\_office}),Common\_Device}

((Vigilant\_1,{Any\_Time}),Door\_Device}

((Vigilant\_1,{Any\_Time}), Advanced\_Device}

((Vigilant\_1,{Any\_Time}),Computer\_Device}

((Vigilant\_1,{Any\_Time}),Fitness\_Device}

((Vigilant\_1,{Any\_Time}),Garage\_Device}

((Vigilant\_1,{Any\_Time}),Wifi\_Device}

((Vigilant\_1,{Any\_Time}),Security\_Device}

((Vigilant\_1,{Any\_Time}),Common\_Device}

((Vigilant\_1,{Any\_Time}),Lighting\_Device}

((Vigilant\_2,{Any\_Time}),Door\_Device}

((Vigilant\_2,{Any\_Time}), Advanced\_Device}

((Vigilant\_2,{Any\_Time}),Computer\_Device}

((Vigilant\_2,{Any\_Time}),Fitness\_Device}

((Vigilant\_2,{Any\_Time}),Garage\_Device}

((Vigilant\_2,{Any\_Time}),Wifi\_Device}

((Vigilant\_2,{Any\_Time}),Security\_Device}

((Vigilant\_2,{Any\_Time}),Common\_Device}

((Vigilant\_2,{Any\_Time}),Lighting\_Device}

((Cleaner\_1,{ At\_office }),Door\_Device}

((Cleaner\_1,{At\_office}),Lighting\_Device}

((Cleaner\_1,{At\_office}),Common\_Device}

((Cleaner\_1,{ At\_office }),Garage\_Device}

((Cleaner\_1,{ At\_office }),Wifi\_Device}

((Cleaner\_2,{ At\_office }),Door\_Device}

((Cleaner\_2,{At\_office}),Lighting\_Device}

((Cleaner\_2,{At\_office}),Common\_Device}

((Cleaner\_2,{ At\_office }),Garage\_Device}

((Cleaner\_2,{ At\_office }),Wifi\_Device}

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**Function assignRPDR**(𝑎𝑢𝑠𝑒𝑟 ∈ 𝐴𝑈𝑠𝑒𝑟,𝑎𝑟 ∈ 𝐴𝑅,𝑟𝑝 ∈ 𝑅𝑃, (Pos, Neg) ∈ 𝐷𝑅, 𝑑𝑟 ∈ 𝐷𝑅) allows a user 𝑎𝑢𝑠𝑒𝑟 with 𝑎𝑟 role to add the (𝑟𝑝,𝑑𝑟) to the set of RPDRA of operational model if the precondition (𝑃𝑜𝑠, 𝑁𝑒𝑔) is met. The precondition is a conjunction of literals where each literal is in a positive form 𝑑𝑟 (when 𝑑𝑟 ∈ 𝑃𝑜𝑠) or a negative form ¬𝑑𝑟 (where 𝑑𝑟 ∈ 𝑁𝑒𝑔) for some 𝑑𝑟 in DR. As a result, the device role dr would be assigned to the role pair rp, adding a new rule to the EGRBAC set of policies.

**AEGRBAC POLICY: assignRPDR**

In this set of assignment functions, a manager gives **RPS** permission to control some devices in the smart building.

In case of emergency, it can access cleaning, biometric and fitness dispositive in order to secure the building and personnel in cases of emergency.

As in the previous stages, first company and second company are defined.

**First building**

assignRPDR(u1,CEO\_1,({(RPS\_1,{Any\_Time}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Entertainment\_Device}))

assignRPDR(u1,CEO\_1,({(RPS\_1,{Any\_Time}),Common\_Device, Door\_Device}))

assignRPDR(u1,CEO\_1,({(RPS\_1,{Any\_Time}),Computer\_Device ,Advanced\_Device}))

assignRPDR(u1,CEO\_1,({(RPS\_1,{Any\_Time}),Computer\_Device ∧ Work\_Device∧ Biometric\_Device,Safe\_Device}))

assignRPDR(u1,CEO\_1,({(RPS\_1,{Any\_Time}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Computer\_Device}))

assignRPDR(u1,CEO\_1,({(RPS\_1,{Any\_Time}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Tablet\_Device}))

assignRPDR(u1,CEO\_1,({(RPS\_1,{Any\_Office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device, Fitness\_Device}))

assignRPDR(u1,CEO\_1,({(RPS\_1,{Any\_Time}),Common\_Device, Garage\_Device}))

assignRPDR(u1,CEO\_1,({(RPS\_1,{Any\_Time}),Common\_Device, Wifi\_Device}))

assignRPDR(u1,CEO\_1,({(RPS\_1,{Emergency\_Time}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device , Kitchen\_Device}))

assignRPDR(u1,CEO\_1,({(RPS\_1,{Any\_Time}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Monitor\_Device}))

assignRPDR(u1,CEO\_1,({(RPS\_1,{Any\_Time}),Advanced\_Device, Security\_Device}))

assignRPDR(u1,CEO\_1,({(RPS\_1,{Any\_Time}),Common\_Device, Lighting\_Device}))

assignRPDR(u1,CEO\_1,({(RPS\_1,{Emergency\_Time}),Door\_Device ∧ Lighting\_Device, Cleaning\_Device}))

assignRPDR(u1,CEO\_1,({(RPS\_1,{Any\_Time}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Work\_Device}))

assignRPDR(u1,CEO\_1,({(RPS\_1,{Any\_Time}),Common\_Device}))

assignRPDR(u1,CEO\_1,({(RPS\_1,{Emergency\_Time}),Fitness\_Device, Fitness\_PT\_Device}))

assignRPDR(u1,CEO\_1,({(RPS\_1,{Emergency\_Time}),Work\_Device, Biometric\_Device}))

**Second building**

assignRPDR(u102,CEO\_2,({(RPS\_2,{Any\_Time}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Entertainment\_Device}))

assignRPDR(u102,CEO\_2,({(RPS\_2,{Any\_Time}),Common\_Device, Door\_Device}))

assignRPDR(u102,CEO\_2,({(RPS\_2,{Any\_Time}),Computer\_Device ,Advanced\_Device}))

assignRPDR(u102,CEO\_2,({(RPS\_2,{Any\_Time}),Computer\_Device ∧ Work\_Device∧ Biometric\_Device,Safe\_Device}))

assignRPDR(u102,CEO\_2,({(RPS\_2,{Any\_Time}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Computer\_Device}))

assignRPDR(u102,CEO\_2,({(RPS\_2,{Any\_Time}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Tablet\_Device}))

assignRPDR(u102,CEO\_2,({(RPS\_2,{Any\_Office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device, Fitness\_Device}))

assignRPDR(u102,CEO\_2,({(RPS\_2,{Any\_Time}),Common\_Device, Garage\_Device}))

assignRPDR(u102,CEO\_2,({(RPS\_2,{Any\_Time}),Common\_Device, Wifi\_Device}))

assignRPDR(u102,CEO\_2,({(RPS\_2,{Emergency\_Time}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device , Kitchen\_Device}))

assignRPDR(u102,CEO\_2,({(RPS\_2,{Any\_Time}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Monitor\_Device}))

assignRPDR(u102,CEO\_2,({(RPS\_2,{Any\_Time}),Advanced\_Device, Security\_Device}))

assignRPDR(u102,CEO\_2,({(RPS\_2,{Any\_Time}),Common\_Device, Lighting\_Device}))

assignRPDR(u102,CEO\_2,({(RPS\_2,{Emergency\_Time}),Door\_Device ∧ Lighting\_Device, Cleaning\_Device}))

assignRPDR(u102,CEO\_2,({(RPS\_2,{Any\_Time}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Work\_Device}))

assignRPDR(u102,CEO\_2,({(RPS\_2,{Any\_Time}),Common\_Device}))

assignRPDR(u102,CEO\_2,({(RPS\_2,{Emergency\_Time}),Fitness\_Device, Fitness\_PT\_Device}))

assignRPDR(u102,CEO\_2,({(RPS\_2,{Emergency\_Time}),Work\_Device, Biometric\_Device}))

In this set of assignment functions, a manager gives **ITE\_Manager** permission to control some Device in the smart building.

It can control common Device, related to lights, doors, garage and wifi if and only if it has access to common Device, i.e. The lights, door and faucet Device in the bathroom and elevator.

It can also, for example, access work\_Device if and only if it has access to lights, doors, and wifi.

**First building**

assignRPDR(u1,CEO\_1,({(ITE\_Manager\_1,{At\_office}),Door\_Device∧Lighting\_Device∧Wifi\_Device,Entertainment\_Device})

assignRPDR(u1,CEO\_1,({(ITE\_Manager\_1,{At\_office}),Common\_Device, Door\_Device}))

assignRPDR(u1,CEO\_1,({(ITE\_Manager\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Computer\_Device}))

assignRPDR(u1,CEO\_1,({(ITE\_Manager\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Tablet\_Device}))

assignRPDR(u1,CEO\_1,({(ITE\_Manager\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device, Fitness\_Device}))

assignRPDR(u1,CEO\_1,({(ITE\_Manager\_1,{At\_office}),Common\_Device, Garage\_Device}))

assignRPDR(u1,CEO\_1,({(ITE\_Manager\_1,{At\_office}),Common\_Device, Wifi\_Device}))

assignRPDR(u1,CEO\_1,({(ITE\_Manager\_1,{At\_office}),Common\_Device, Lighting\_Device}))

assignRPDR(u1,CEO\_1,({(ITE\_Manager\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Work\_Device}))

assignRPDR(u1,CEO\_1,({(ITE\_Manager\_1,{At\_office}),Common\_Device}))

**Second building**

assignRPDR(u102,CEO\_2,({(ITE\_Manager\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Entertainment\_Device}))

assignRPDR(u102,CEO\_2,({(ITE\_Manager\_2,{At\_office}),Common\_Device, Door\_Device}))

assignRPDR(u102,CEO\_2,({(ITE\_Manager\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Computer\_Device}))

assignRPDR(u102,CEO\_2,({(ITE\_Manager\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Tablet\_Device}))

assignRPDR(u102,CEO\_2,({(ITE\_Manager\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device, Fitness\_Device}))

assignRPDR(u102,CEO\_2,({(ITE\_Manager\_2,{At\_office}),Common\_Device, Garage\_Device}))

assignRPDR(u102,CEO\_2,({(ITE\_Manager\_2,{At\_office}),Common\_Device, Wifi\_Device}))

assignRPDR(u102,CEO\_2,({(ITE\_Manager\_2,{At\_office}),Common\_Device, Lighting\_Device}))

assignRPDR(u102,CEO\_2,({(ITE\_Manager\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Work\_Device}))

assignRPDR(u102,CEO\_2,({(ITE\_Manager\_2,{At\_office}),Common\_Device}))

In this set of assignment functions, a manager gives **NC\_Engineer** permission to control some Device in the smart building .

It can control common Device, related to lights, doors, garage and wifi if and only if it has access to common Device, i.e. The lights, door and faucet Device in the bathroom and elevator.

It can also, for example, access tablet\_device if and only if it has access to lights, doors and wifi.

**First building**

assignRPDR(u1,CEO\_1,({(NC\_Engineer\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Entertainment\_Device}))

assignRPDR(u1,CEO\_1,({(NC\_Engineer\_1,{At\_office}),Common\_Device, Door\_Device}))

assignRPDR(u1,CEO\_1,({(NC\_Engineer\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Computer\_Device}))

assignRPDR(u1,CEO\_1,({(NC\_Engineer\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Tablet\_Device}))

assignRPDR(u1,CEO\_1,({(NC\_Engineer\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device, Fitness\_Device}))

assignRPDR(u1,CEO\_1,({(NC\_Engineer\_1,{At\_office}),Common\_Device, Garage\_Device}))

assignRPDR(u1,CEO\_1,({(NC\_Engineer\_1,{At\_office}),Common\_Device, Wifi\_Device}))

assignRPDR(u1,CEO\_1,({(NC\_Engineer\_1,{At\_office}),Common\_Device, Lighting\_Device}))

assignRPDR(u1,CEO\_1,({(NC\_Engineer\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Work\_Device}))

assignRPDR(u1,CEO\_1,({(NC\_Engineer\_1,{At\_office}),Common\_Device}))

**Second building**

assignRPDR(u102,CEO\_2,({(NC\_Engineer\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Entertainment\_Device}))

assignRPDR(u102,CEO\_2,({(NC\_Engineer\_2,{At\_office}),Common\_Device, Door\_Device}))

assignRPDR(u102,CEO\_2,({(NC\_Engineer\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Computer\_Device}))

assignRPDR(u102,CEO\_2,({(NC\_Engineer\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Tablet\_Device}))

assignRPDR(u102,CEO\_2,({(NC\_Engineer\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device, Fitness\_Device}))

assignRPDR(u102,CEO\_2,({(NC\_Engineer\_2,{At\_office}),Common\_Device, Garage\_Device}))

assignRPDR(u102,CEO\_2,({(NC\_Engineer\_2,{At\_office}),Common\_Device, Wifi\_Device}))

assignRPDR(u102,CEO\_2,({(NC\_Engineer\_2,{At\_office}),Common\_Device, Lighting\_Device}))

assignRPDR(u102,CEO\_2,({(NC\_Engineer\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Work\_Device}))

assignRPDR(u102,CEO\_2,({(NC\_Engineer\_2,{At\_office}),Common\_Device}))

In this set of assignment functions, a manager gives **ES\_Engineer** permission to control some Device in the smart building .

It can control common Device, related to lights, doors, garage and wifi if and only if it has access to common Device, i.e. The lights, door and faucet Device in the bathroom and elevator.

It can also, for example, access computer\_device if and only if it has access to lights, doors, and wifi.

**First building**

assignRPDR(u1,CEO\_1,({(ES\_Engineer\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Entertainment\_Device}))

assignRPDR(u1,CEO\_1,({(ES\_Engineer\_1,{At\_office}),Common\_Device, Door\_Device}))

assignRPDR(u1,CEO\_1,({(ES\_Engineer\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Computer\_Device}))

assignRPDR(u1,CEO\_1,({(ES\_Engineer\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Tablet\_Device}))

assignRPDR(u1,CEO\_1,({(ES\_Engineer\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device, Fitness\_Device}))

assignRPDR(u1,CEO\_1,({(ES\_Engineer\_1,{At\_office}),Common\_Device, Garage\_Device}))

assignRPDR(u1,CEO\_1,({(ES\_Engineer\_1,{At\_office}),Common\_Device, Wifi\_Device}))

assignRPDR(u1,CEO\_1,({(ES\_Engineer\_1,{At\_office}),Common\_Device, Lighting\_Device}))

assignRPDR(u1,CEO\_1,({(ES\_Engineer\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Work\_Device}))

assignRPDR(u1,CEO\_1,({(ES\_Engineer\_1,{At\_office}),Common\_Device}))

**Second building**

assignRPDR(u102,CEO\_2,({(ES\_Engineer\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Entertainment\_Device}))

assignRPDR(u102,CEO\_2,({(ES\_Engineer\_2,{At\_office}),Common\_Device, Door\_Device}))

assignRPDR(u102,CEO\_2,({(ES\_Engineer\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Computer\_Device}))

assignRPDR(u102,CEO\_2,({(ES\_Engineer\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Tablet\_Device}))

assignRPDR(u102,CEO\_2,({(ES\_Engineer\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device, Fitness\_Device}))

assignRPDR(u102,CEO\_2,({(ES\_Engineer\_2,{At\_office}),Common\_Device, Garage\_Device}))

assignRPDR(u102,CEO\_2,({(ES\_Engineer\_2,{At\_office}),Common\_Device, Wifi\_Device}))

assignRPDR(u102,CEO\_2,({(ES\_Engineer\_2,{At\_office}),Common\_Device, Lighting\_Device}))

assignRPDR(u102,CEO\_2,({(ES\_Engineer\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Work\_Device}))

assignRPDR(u102,CEO\_2,({(ES\_Engineer\_2,{At\_office}),Common\_Device}))

In this set of assignment functions, a manager gives **IT** permission to control some Device in the smart building .

It can control common Device, related to lights, doors, garage and wifi if and only if it has access to common Device, i.e. The lights, door and faucet Device in the bathroom and elevator.

It can also, for example, access Entertainment\_Device if and only if it has access to lights, doors, and wifi.

**First Building**

assignRPDR(u1,CEO\_1,({(IT\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Entertainment\_Device}))

assignRPDR(u1,CEO\_1,({(IT\_1,{At\_office}),Common\_Device, Door\_Device}))

assignRPDR(u1,CEO\_1,({(IT\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Computer\_Device}))

assignRPDR(u1,CEO\_1,({(IT\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Tablet\_Device}))

assignRPDR(u1,CEO\_1,({(IT\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device, Fitness\_Device}))

assignRPDR(u1,CEO\_1,({(IT\_1,{At\_office}),Common\_Device, Garage\_Device}))

assignRPDR(u1,CEO\_1,({(IT\_1,{At\_office}),Common\_Device, Wifi\_Device}))

assignRPDR(u1,CEO\_1,({(IT\_1,{At\_office}),Common\_Device, Lighting\_Device}))

assignRPDR(u1,CEO\_1,({(IT\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Work\_Device}))

assignRPDR(u1,CEO\_1,({(IT\_1,{At\_office}),Common\_Device}))

**Second building**

assignRPDR(u102,CEO\_2,({(IT\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Entertainment\_Device}))

assignRPDR(u102,CEO\_2,({(IT\_2,{At\_office}),Common\_Device, Door\_Device}))

assignRPDR(u102,CEO\_2,({(IT\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Computer\_Device}))

assignRPDR(u102,CEO\_2,({(IT\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Tablet\_Device}))

assignRPDR(u102,CEO\_2,({(IT\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device, Fitness\_Device}))

assignRPDR(u102,CEO\_2,({(IT\_2,{At\_office}),Common\_Device, Garage\_Device}))

assignRPDR(u102,CEO\_2,({(IT\_2,{At\_office}),Common\_Device, Wifi\_Device}))

assignRPDR(u102,CEO\_2,({(IT\_2,{At\_office}),Common\_Device, Lighting\_Device}))

assignRPDR(u102,CEO\_2,({(IT\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Work\_Device}))

assignRPDR(u102,CEO\_2,({(IT\_2,{At\_office}),Common\_Device}))

In this set of assignment functions, a manager gives **HR\_Manager** permission to control some Device in the smart building .

It can control common Device, related to lights, doors, garage, and wifi if and only if it has access to common Device, i.e., The lights, door, and bathroom faucet and elevator Device.

In addition, it can, for example, access safe\_device if and only if it has access to work\_device through its own pair of credentials, i.e., it has access to employees' PCs except for the PCs of the 'administrator, managers, and vigilantes, as they fall under security\_device. (work\_device has in addition alexa, repect to computer\_Device)and to biometric\_device that allows fingerprint recognition in order to access and open and close the safe.

In contrast, it cannot access biometric\_controlled, as they are the administrator can enter or delete fingerprints from the DB.

**First buinding**

assignRPDR(u1,CEO\_1,({(HR\_Manager\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Entertainment\_Device}))

assignRPDR(u1,CEO\_1,({(HR\_Manager\_1,{At\_office}),Common\_Device, Door\_Device}))

assignRPDR(u1,CEO\_1,({(HR\_Manager\_1,{At\_office}),Computer\_Device ∧ Work\_Device∧ Biometric\_Device,Safe\_Device}))

assignRPDR(u1,CEO\_1,({(HR\_Manager\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Computer\_Device}))

assignRPDR(u1,CEO\_1,({(HR\_Manager\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Tablet\_Device}))

assignRPDR(u1,CEO\_1,({(HR\_Manager\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device, Fitness\_Device}))

assignRPDR(u1,CEO\_1,({(HR\_Manager\_1,{At\_office}),Common\_Device, Garage\_Device}))

assignRPDR(u1,CEO\_1,({(HR\_Manager\_1,{At\_office}),Common\_Device, Wifi\_Device}))

assignRPDR(u1,CEO\_1,({(HR\_Manager\_1,{At\_office}),Common\_Device, Lighting\_Device}))

assignRPDR(u1,CEO\_1,({(HR\_Manager\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Work\_Device}))

assignRPDR(u1,CEO\_1,({(HR\_Manager\_1,{At\_office}),Common\_Device}))

assignRPDR(u1,CEO\_1,({(HR\_Manager\_1,{At\_office}),Work\_Device, Biometric\_Device}))

**Second building**

assignRPDR(u102,CEO\_2,({(HR\_Manager\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Entertainment\_Device}))

assignRPDR(u102,CEO\_2,({(HR\_Manager\_2,{At\_office}),Common\_Device, Door\_Device}))

assignRPDR(u102,CEO\_2,({(HR\_Manager\_2,{At\_office}),Computer\_Device ∧ Work\_Device∧ Biometric\_Device,Safe\_Device}))

assignRPDR(u102,CEO\_2,({(HR\_Manager\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Computer\_Device}))

assignRPDR(u102,CEO\_2,({(HR\_Manager\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Tablet\_Device}))

assignRPDR(u102,CEO\_2,({(HR\_Manager\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device, Fitness\_Device}))

assignRPDR(u102,CEO\_2,({(HR\_Manager\_2,{At\_office}),Common\_Device, Garage\_Device}))

assignRPDR(u102,CEO\_2,({(HR\_Manager\_2,{At\_office}),Common\_Device, Wifi\_Device}))

assignRPDR(u102,CEO\_2,({(HR\_Manager\_2,{At\_office}),Common\_Device, Lighting\_Device}))

assignRPDR(u102,CEO\_2,({(HR\_Manager\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Work\_Device}))

assignRPDR(u102,CEO\_2,({(HR\_Manager\_2,{At\_office}),Common\_Device}))

assignRPDR(u102,CEO\_2,({(HR\_Manager\_2,{At\_office}),Work\_Device, Biometric\_Device}))

In this set of assignment functions, a manager gives **Adm\_empl** permission to control some Device in the smart building.

It can control common Device, related to lights, doors, garage, and wifi if and only if it has access to common Device, i.e. The lights, door, and bathroom faucet and elevator Device.

**First building**

assignRPDR(u1,CEO\_1 ,({(Adm\_empl\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Entertainment\_Device}))

assignRPDR(u1,CEO\_1 ,({(Adm\_empl\_1,{At\_office}),Common\_Device, Door\_Device}))

assignRPDR(u1,CEO\_1 ,({(Adm\_empl\_1,{At\_office}),Computer\_Device ∧ Work\_Device ∧ Biometric\_Device,Safe\_Device}))

assignRPDR(u1,CEO\_1 ,({(Adm\_empl\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Computer\_Device}))

assignRPDR(u1,CEO\_1 ,({(Adm\_empl\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Tablet\_Device}))

assignRPDR(u1,CEO\_1 ,({(Adm\_empl\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device, Fitness\_Device}))

assignRPDR(u1,CEO\_1 ,({(Adm\_empl\_1,{At\_office}),Common\_Device, Garage\_Device}))

assignRPDR(u1,CEO\_1 ,({(Adm\_empl\_1,{At\_office}),Common\_Device, Wifi\_Device}))

assignRPDR(u1,CEO\_1 ,({(Adm\_empl\_1,{At\_office}),Common\_Device, Lighting\_Device}))

assignRPDR(u1,CEO\_1 ,({(Adm\_empl\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Work\_Device}))

assignRPDR(u1,CEO\_1 ,({(Adm\_empl\_1,{At\_office}),Common\_Device}))

assignRPDR(u1,CEO\_1 ,({(Adm\_empl\_1,{At\_office}),Work\_Device, Biometric\_Device}))

**Second building**

assignRPDR(u102,CEO\_2 ,({(Adm\_empl\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Entertainment\_Device}))

assignRPDR(u102,CEO\_2 ,({(Adm\_empl\_2,{At\_office}),Common\_Device, Door\_Device}))

assignRPDR(u102,CEO\_2 ,({(Adm\_empl\_2,{At\_office}),Computer\_Device ∧ Work\_Device ∧ Biometric\_Device,Safe\_Device}))

assignRPDR(u102,CEO\_2 ,({(Adm\_empl\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Computer\_Device}))

assignRPDR(u102,CEO\_2 ,({(Adm\_empl\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Tablet\_Device}))

assignRPDR(u102,CEO\_2 ,({(Adm\_empl\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device, Fitness\_Device}))

assignRPDR(u102,CEO\_2 ,({(Adm\_empl\_2,{At\_office}),Common\_Device, Garage\_Device}))

assignRPDR(u102,CEO\_2 ,({(Adm\_empl\_2,{At\_office}),Common\_Device, Wifi\_Device}))

assignRPDR(u102,CEO\_2 ,({(Adm\_empl\_2,{At\_office}),Common\_Device, Lighting\_Device}))

assignRPDR(u102,CEO\_2 ,({(Adm\_empl\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Work\_Device}))

assignRPDR(u102,CEO\_2 ,({(Adm\_empl\_2,{At\_office}),Common\_Device}))

assignRPDR(u102,CEO\_2 ,({(Adm\_empl\_2,{At\_office}),Work\_Device, Biometric\_Device}))

In this set of assignment functions, a manager gives **receptionist** permission to control some Device in the smart building.

**First building**

assignRPDR(u1,CEO\_1,({(Receptionist\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Entertainment\_Device}))

assignRPDR(u1,CEO\_1,({(Receptionist\_1,{At\_office}),Common\_Device, Door\_Device}))

assignRPDR(u1,CEO\_1,({(Receptionist\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Computer\_Device}))

assignRPDR(u1,CEO\_1,({(Receptionist\_1,{Any\_Time}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Tablet\_Device}))

assignRPDR(u1,CEO\_1,({(Receptionist\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device, Fitness\_Device}))

assignRPDR(u1,CEO\_1,({(Receptionist\_1,{At\_office}),Common\_Device, Garage\_Device}))

assignRPDR(u1,CEO\_1,({(Receptionist\_1,{At\_office}),Common\_Device, Wifi\_Device}))

assignRPDR(u1,CEO\_1,({(Receptionist\_1,{Any\_Time}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Monitor\_Device}))

assignRPDR(u1,CEO\_1,({(Receptionist\_1,{At\_office}),Common\_Device, Lighting\_Device}))

assignRPDR(u1,CEO\_1,({(Receptionist\_1,{Any\_Time}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Work\_Device}))

assignRPDR(u1,CEO\_1,({(Receptionist\_1,{At\_office}),Common\_Device}))

**Second building**

assignRPDR(u102,CEO\_2,({(Receptionist\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Entertainment\_Device}))

assignRPDR(u102,CEO\_2,({(Receptionist\_2,{At\_office}),Common\_Device, Door\_Device}))

assignRPDR(u102,CEO\_2,({(Receptionist\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Computer\_Device}))

assignRPDR(u102,CEO\_2,({(Receptionist\_2,{Any\_Time}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Tablet\_Device}))

assignRPDR(u102,CEO\_2,({(Receptionist\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device, Fitness\_Device}))

assignRPDR(u102,CEO\_2,({(Receptionist\_2,{At\_office}),Common\_Device, Garage\_Device}))

assignRPDR(u102,CEO\_2,({(Receptionist\_2,{At\_office}),Common\_Device, Wifi\_Device}))

assignRPDR(u102,CEO\_2,({(Receptionist\_2,{Any\_Time}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Monitor\_Device}))

assignRPDR(u102,CEO\_2,({(Receptionist\_2,{At\_office}),Common\_Device, Lighting\_Device}))

assignRPDR(u102,CEO\_2,({(Receptionist\_2,{Any\_Time}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Work\_Device}))

assignRPDR(u102,CEO\_2,({(Receptionist\_2,{At\_office}),Common\_Device}))

In this set of assignment functions, a manager gives **waiter** permission to control some Device in the smart building.

**First building**

assignRPDR(u2,RPS\_1,({(Waiter\_1,{At\_office}),Common\_Device, Door\_Device}))

assignRPDR(u2,RPS\_1,({(Waiter\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Tablet\_Device}))

assignRPDR(u2,RPS\_1,({(Waiter\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device, Fitness\_Device}))

assignRPDR(u2,RPS\_1,({(Waiter\_1,{At\_office}),Common\_Device, Garage\_Device}))

assignRPDR(u2,RPS\_1,({(Waiter\_1,{At\_office}),Common\_Device, Wifi\_Device}))

assignRPDR(u2,RPS\_1,({(Waiter\_1,{Any\_Time}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device , Kitchen\_Device}))

assignRPDR(u2,RPS\_1,({(Waiter\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Monitor\_Device}))

assignRPDR(u2,RPS\_1,({(Waiter\_1,{At\_office}),Common\_Device, Lighting\_Device}))

assignRPDR(u2,RPS\_1,({(Waiter\_1,{At\_office}),Common\_Device}))

**Second building**

assignRPDR(u103,RPS\_2,({(Waiter\_2,{At\_office}),Common\_Device, Door\_Device}))

assignRPDR(u103,RPS\_2,({(Waiter\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Tablet\_Device}))

assignRPDR(u103,RPS\_2,({(Waiter\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device, Fitness\_Device}))

assignRPDR(u103,RPS\_2,({(Waiter\_2,{At\_office}),Common\_Device, Garage\_Device}))

assignRPDR(u103,RPS\_2,({(Waiter\_2,{At\_office}),Common\_Device, Wifi\_Device}))

assignRPDR(u103,RPS\_2,({(Waiter\_2,{Any\_Time}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device , Kitchen\_Device}))

assignRPDR(u103,RPS\_2,({(Waiter\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Monitor\_Device}))

assignRPDR(u103,RPS\_2,({(Waiter\_2,{At\_office}),Common\_Device, Lighting\_Device}))

assignRPDR(u103,RPS\_2,({(Waiter\_2,{At\_office}),Common\_Device}))

In this set of assignment functions, a manager gives **PT** permission to control some Device in the smart building.

**First building**

assignRPDR(u2,RPS\_1,({(PT\_1,{At\_office}),Common\_Device, Door\_Device}))

assignRPDR(u2,RPS\_1,({(PT\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Tablet\_Device}))

assignRPDR(u2,RPS\_1,({(PT\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device, Fitness\_Device}))

assignRPDR(u2,RPS\_1,({(PT\_1,{At\_office}),Common\_Device, Garage\_Device}))

assignRPDR(u2,RPS\_1,({(PT\_1,{At\_office}),Common\_Device, Wifi\_Device}))

assignRPDR(u2,RPS\_1,({(PT\_1,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Monitor\_Device}))

assignRPDR(u2,RPS\_1,({(PT\_1,{At\_office}),Common\_Device, Lighting\_Device}))

assignRPDR(u2,RPS\_1,({(PT\_1,{At\_office}),Common\_Device}))

assignRPDR(u2,RPS\_1,({(PT\_1,{At\_office}),Fitness\_Device, Fitness\_PT\_Device}))

**Second building**

assignRPDR(u103,RPS\_2,({(PT\_2,{At\_office}),Common\_Device, Door\_Device}))

assignRPDR(u103,RPS\_2,({(PT\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Tablet\_Device}))

assignRPDR(u103,RPS\_2,({(PT\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device, Fitness\_Device}))

assignRPDR(u103,RPS\_2,({(PT\_2,{At\_office}),Common\_Device, Garage\_Device}))

assignRPDR(u103,RPS\_2,({(PT\_2,{At\_office}),Common\_Device, Wifi\_Device}))

assignRPDR(u103,RPS\_2,({(PT\_2,{At\_office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Monitor\_Device}))

assignRPDR(u103,RPS\_2,({(PT\_2,{At\_office}),Common\_Device, Lighting\_Device}))

assignRPDR(u103,RPS\_2,({(PT\_2,{At\_office}),Common\_Device}))

assignRPDR(u103,RPS\_2,({(PT\_2,{At\_office}),Fitness\_Device, Fitness\_PT\_Device}))

In this set of assignment functions, a manager gives **Gym client** permission to control some Device in the smart building.

**First building**

assignRPDR(u2,RPS\_1,({(Gym\_client\_1,{ At\_Office }),Common\_Device, Door\_Device}))

assignRPDR(u2,RPS\_1,({(Gym\_client\_1,{ At\_Office }),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Tablet\_Device}))

assignRPDR(u2,RPS\_1,({(Gym\_client\_1,{ At\_Office }),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device, Fitness\_Device}))

assignRPDR(u2,RPS\_1,({(Gym\_client\_1,{ At\_Office }),Common\_Device, Garage\_Device}))

assignRPDR(u2,RPS\_1,({(Gym\_client\_1,{ At\_Office }),Common\_Device, Wifi\_Device}))

assignRPDR(u2,RPS\_1,({(Gym\_client\_1,{ At\_Office }),Common\_Device, Lighting\_Device}))

assignRPDR(u2,RPS\_1,({(Gym\_client\_1,{ At\_Office }),Common\_Device}))

**Second building**

assignRPDR(u103,RPS\_2,({(Gym\_client\_2,{ At\_Office }),Common\_Device, Door\_Device}))

assignRPDR(u103,RPS\_2,({(Gym\_client\_2,{ At\_Office }),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Tablet\_Device}))

assignRPDR(u103,RPS\_2,({(Gym\_client\_2,{ At\_Office }),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device, Fitness\_Device}))

assignRPDR(u103,RPS\_2,({(Gym\_client\_2,{ At\_Office }),Common\_Device, Garage\_Device}))

assignRPDR(u103,RPS\_2,({(Gym\_client\_2,{ At\_Office }),Common\_Device, Wifi\_Device}))

assignRPDR(u103,RPS\_2,({(Gym\_client\_2,{ At\_Office }),Common\_Device, Lighting\_Device}))

assignRPDR(u103,RPS\_2,({(Gym\_client\_2,{ At\_Office}),Common\_Device}))

In this set of assignment functions, a manager gives **Chef** permission to control some Device in the smart building.

**First building**

assignRPDR(u2,RPS\_1,({(Chef\_1,{At\_Office}),Common\_Device, Door\_Device}))

assignRPDR(u2,RPS\_1,({(Chef\_1,{At\_Office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Tablet\_Device}))

assignRPDR(u2,RPS\_1,({(Chef\_1,{At\_Office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device, Fitness\_Device}))

assignRPDR(u2,RPS\_1,({(Chef\_1,{At\_Office}),Common\_Device, Garage\_Device}))

assignRPDR(u2,RPS\_1,({(Chef\_1,{At\_Office}),Common\_Device, Wifi\_Device}))

assignRPDR(u2,RPS\_1,({(Chef\_1,{At\_Office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device , Kitchen\_Device}))

assignRPDR(u2,RPS\_1,({(Chef\_1,{At\_Office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Monitor\_Device}))

assignRPDR(u2,RPS\_1,({(Chef\_1,{At\_Office}),Common\_Device, Lighting\_Device}))

assignRPDR(u2,RPS\_1,({(Chef\_1,{At\_Office}),Common\_Device}))

**Second building**

assignRPDR(u103,RPS\_2,({(Chef\_2,{At\_Office}),Common\_Device, Door\_Device}))

assignRPDR(u103,RPS\_2,({(Chef\_2,{At\_Office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Tablet\_Device}))

assignRPDR(u103,RPS\_2,({(Chef\_2,{At\_Office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device, Fitness\_Device}))

assignRPDR(u103,RPS\_2,({(Chef\_2,{At\_Office}),Common\_Device, Garage\_Device}))

assignRPDR(u103,RPS\_2,({(Chef\_2,{At\_Office}),Common\_Device, Wifi\_Device}))

assignRPDR(u103,RPS\_2,({(Chef\_2,{At\_Office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device , Kitchen\_Device}))

assignRPDR(u103,RPS\_2,({(Chef\_2,{At\_Office}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Monitor\_Device}))

assignRPDR(u103,RPS\_2,({(Chef\_2,{At\_Office}),Common\_Device, Lighting\_Device}))

assignRPDR(u103,RPS\_2,({(Chef\_2,{At\_Office}),Common\_Device}))

In this set of assignment functions, a manager gives **Guest** permission to control common Device in the smart building.

**First building**

assignRPDR(u2,RPS\_1,({(Guest\_1,{At\_office}),Common\_Device}))

**Second building**

assignRPDR(u103,RPS\_2,({(Guest\_2,{At\_office}),Common\_Device}))

In this set of assignment functions, a manager gives **Vigilant** permission to control some Device in the smart building.

**First building**

assignRPDR(u1,CEO\_1,({(Vigilant\_1,{Any\_Time}),Common\_Device, Door\_Device}))

assignRPDR(u1,CEO\_1,({(Vigilant\_1,{Any\_Time}),Computer\_Device ,Advanced\_Device}))

assignRPDR(u1,CEO\_1,({(Vigilant\_1,{Any\_Time}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Computer\_Device}))

assignRPDR(u1,CEO\_1,({(Vigilant\_1,{Any\_Time}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device, Fitness\_Device}))

assignRPDR(u1,CEO\_1,({(Vigilant\_1,{Any\_Time}),Common\_Device, Garage\_Device}))

assignRPDR(u1,CEO\_1,({(Vigilant\_1,{Any\_Time}),Common\_Device, Wifi\_Device}))

assignRPDR(u1,CEO\_1,({(Vigilant\_1,{Any\_Time}),Advanced\_Device, Security\_Device}))

assignRPDR(u1,CEO\_1,({(Vigilant\_1,{Any\_Time}),Common\_Device, Lighting\_Device}))

assignRPDR(u1,CEO\_1,({(Vigilant\_1,{Any\_Time}),Common\_Device}))

**Second building**

assignRPDR(u102,CEO\_2,({(Vigilant\_2,{Any\_Time}),Common\_Device, Door\_Device}))

assignRPDR(u102,CEO\_2,({(Vigilant\_2,{Any\_Time}),Computer\_Device ,Advanced\_Device}))

assignRPDR(u102,CEO\_2,({(Vigilant\_2,{Any\_Time}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device,Computer\_Device}))

assignRPDR(u102,CEO\_2,({(Vigilant\_2,{Any\_Time}),Door\_Device ∧ Lighting\_Device ∧ Wifi\_Device, Fitness\_Device}))

assignRPDR(u102,CEO\_2,({(Vigilant\_2,{Any\_Time}),Common\_Device, Garage\_Device}))

assignRPDR(u102,CEO\_2,({(Vigilant\_2,{Any\_Time}),Common\_Device, Wifi\_Device}))

assignRPDR(u102,CEO\_2,({(Vigilant\_2,{Any\_Time}),Advanced\_Device, Security\_Device}))

assignRPDR(u102,CEO\_2,({(Vigilant\_2,{Any\_Time}),Common\_Device, Lighting\_Device}))

assignRPDR(u102,CEO\_2,({(Vigilant\_2,{Any\_Time}),Common\_Device}))

In this set of assignment functions, a manager gives **Cleaner** permission to control some Device in the smart building.

**First building**

assignRPDR(u2,RPS\_1,({(Cleaner\_1,{At\_office}),Common\_Device, Door\_Device}))

assignRPDR(u2,RPS\_1,({(Cleaner\_1,{At\_office}),Common\_Device, Garage\_Device}))

assignRPDR(u2,RPS\_1,({(Cleaner\_1,{At\_office}),Common\_Device, Wifi\_Device}))

assignRPDR(u2,RPS\_1,({(Cleaner\_1,{At\_office}),Common\_Device, Lighting\_Device}))

assignRPDR(u2,RPS\_1,({(Cleaner\_1,{At\_office}),Common\_Device}))

**Second building**

assignRPDR(u103,RPS\_2,({(Cleaner\_2,{At\_office}),Common\_Device, Door\_Device}))

assignRPDR(u103,RPS\_2,({(Cleaner\_2,{At\_office}),Common\_Device, Garage\_Device}))

assignRPDR(u103,RPS\_2,({(Cleaner\_2,{At\_office}),Common\_Device, Wifi\_Device}))

assignRPDR(u103,RPS\_2,({(Cleaner\_2,{At\_office}),Common\_Device, Lighting\_Device}))

assignRPDR(u103,RPS\_2,({(Cleaner\_2,{At\_office}),Common\_Device}))

In this set of assignment functions, a manager gives **CTO** permission to control some Device in the smart building.

assignRPDR(u203,CEO1\_1,({(CTO,{Any\_Time}),HVAC\_Devices}))

assignRPDR(u203,CEO\_1,({(CTO,{Any\_Time}),BMS\_Devices}))

assignRPDR(u203,CEO\_1,({(CTO,{Any\_Time}), Environmental\_data\_storage ∧ Monitoring\_energy\_resources

,Pc\_CTO}))

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**AEGRBAC POLICY: revokeRPDR**

Function revokeRPDR(𝑎𝑢𝑠𝑒𝑟 ∈ 𝐴𝑈𝑠𝑒𝑟,𝑎𝑟 ∈ 𝐴𝑅,𝑟𝑝 ∈ 𝑅𝑃,𝑑𝑟 ∈ 𝐷𝑅) would allow an administrator user 𝑎𝑢𝑠𝑒𝑟 with 𝑎𝑟 role to revoke a device role from a role pair.

For each rule assignRPDR, there is a corresponding rule revokeRPDR, so we won’t provide a further explanation.

**First building**

revokeRPDR(u1,CEO\_1,({(ITE\_Manager\_1,{At\_office}),Entertainment\_Device}))

revokeRPDR(u1,CEO\_1,({(ITE\_Manager\_1,{At\_office}),Door\_Device}))

revokeRPDR(u1,CEO\_1,({(ITE\_Manager\_1,{At\_office}),Computer\_Device}))

revokeRPDR(u1,CEO\_1,({(ITE\_Manager\_1,{At\_office}),Tablet\_Device}))

revokeRPDR(u1,CEO\_1,({(ITE\_Manager\_1,{At\_office}),Fitness\_Device}))

revokeRPDR(u1,CEO\_1,({(ITE\_Manager\_1,{At\_office}),Garage\_Device}))

revokeRPDR(u1,CEO\_1,({(ITE\_Manager\_1,{At\_office}),Wifi\_Device}))

revokeRPDR(u1,CEO\_1,({(ITE\_Manager\_1,{At\_office}),Lighting\_Device}))

revokeRPDR(u1,CEO\_1,({(ITE\_Manager\_1,{At\_office}),Work\_Device}))

revokeRPDR(u1,CEO\_1,({(ITE\_Manager\_1,{At\_office}),Common\_Device}))

**Second building**

revokeRPDR(u1,CEO\_2,({(ITE\_Manager\_2,{At\_office}),Entertainment\_Device}))

revokeRPDR(u1,CEO\_2,({(ITE\_Manager\_2,{At\_office}),Door\_Device}))

revokeRPDR(u1,CEO\_2,({(ITE\_Manager\_2,{At\_office}),Computer\_Device}))

revokeRPDR(u1,CEO\_2,({(ITE\_Manager\_2,{At\_office}),Tablet\_Device}))

revokeRPDR(u1,CEO\_2,({(ITE\_Manager\_2,{At\_office}),Fitness\_Device}))

revokeRPDR(u1,CEO\_2,({(ITE\_Manager\_2,{At\_office}),Garage\_Device}))

revokeRPDR(u1,CEO\_2,({(ITE\_Manager\_2,{At\_office}),Wifi\_Device}))

revokeRPDR(u1,CEO\_2,({(ITE\_Manager\_2,{At\_office}),Lighting\_Device}))

revokeRPDR(u1,CEO\_2,({(ITE\_Manager\_2,{At\_office}),Work\_Device}))

revokeRPDR(u1,CEO\_2,({(ITE\_Manager\_2,{At\_office}),Common\_Device}))

**First building**

revokeRPDR(u1,CEO\_1,({(NC\_Engineer\_1,{At\_office}),Entertainment\_Device}))

revokeRPDR(u1,CEO\_1,({(NC\_Engineer\_1,{At\_office}),Door\_Device}))

revokeRPDR(u1,CEO\_1,({(NC\_Engineer\_1,{At\_office}),Computer\_Device}))

revokeRPDR(u1,CEO\_1,({(NC\_Engineer\_1,{At\_office}),Tablet\_Device}))

revokeRPDR(u1,CEO\_1,({(NC\_Engineer\_1,{At\_office}),Fitness\_Device}))

revokeRPDR(u1,CEO\_1,({(NC\_Engineer\_1,{At\_office}),Garage\_Device}))

revokeRPDR(u1,CEO\_1,({(NC\_Engineer\_1,{At\_office}),Wifi\_Device}))

revokeRPDR(u1,CEO\_1,({(NC\_Engineer\_1,{At\_office}),Lighting\_Device}))

revokeRPDR(u1,CEO\_1,({(NC\_Engineer\_1,{At\_office}),Work\_Device}))

revokeRPDR(u1,CEO\_1,({(NC\_Engineer\_1,{At\_office}),Common\_Device}))

**Second building**

revokeRPDR(u1,CEO\_2,({(NC\_Engineer\_2,{At\_office}),Entertainment\_Device}))

revokeRPDR(u1,CEO\_2,({(NC\_Engineer\_2,{At\_office}),Door\_Device}))

revokeRPDR(u1,CEO\_2,({(NC\_Engineer\_2,{At\_office}),Computer\_Device}))

revokeRPDR(u1,CEO\_2,({(NC\_Engineer\_2,{At\_office}),Tablet\_Device}))

revokeRPDR(u1,CEO\_2,({(NC\_Engineer\_2,{At\_office}),Fitness\_Device}))

revokeRPDR(u1,CEO\_2,({(NC\_Engineer\_2,{At\_office}),Garage\_Device}))

revokeRPDR(u1,CEO\_2,({(NC\_Engineer\_2,{At\_office}),Wifi\_Device}))

revokeRPDR(u1,CEO\_2,({(NC\_Engineer\_2,{At\_office}),Lighting\_Device}))

revokeRPDR(u1,CEO\_2,({(NC\_Engineer\_2,{At\_office}),Work\_Device}))

revokeRPDR(u1,CEO\_2,({(NC\_Engineer\_2,{At\_office}),Common\_Device}))

**First building**

revokeRPDR(u1,CEO\_1,({(ES\_Engineer\_1,{At\_office}),Entertainment\_Device}))

revokeRPDR(u1,CEO\_1,({(ES\_Engineer\_1,{At\_office}),Door\_Device}))

revokeRPDR(u1,CEO\_1,({(ES\_Engineer\_1,{At\_office}),Computer\_Device}))

revokeRPDR(u1,CEO\_1,({(ES\_Engineer\_1,{At\_office}),Tablet\_Device}))

revokeRPDR(u1,CEO\_1,({(ES\_Engineer\_1,{At\_office}),Fitness\_Device}))

revokeRPDR(u1,CEO\_1,({(ES\_Engineer\_1,{At\_office}),Garage\_Device}))

revokeRPDR(u1,CEO\_1,({(ES\_Engineer\_1,{At\_office}),Wifi\_Device}))

revokeRPDR(u1,CEO\_1,({(ES\_Engineer\_1,{At\_office}),Lighting\_Device}))

revokeRPDR(u1,CEO\_1,({(ES\_Engineer\_1,{At\_office}),Work\_Device}))

revokeRPDR(u1,CEO\_1,({(ES\_Engineer\_1,{At\_office}),Common\_Device}))

**Second building**

revokeRPDR(u1,CEO\_2,({(ES\_Engineer\_2,{At\_office}),Entertainment\_Device}))

revokeRPDR(u1,CEO\_2,({(ES\_Engineer\_2,{At\_office}),Door\_Device}))

revokeRPDR(u1,CEO\_2,({(ES\_Engineer\_2,{At\_office}),Computer\_Device}))

revokeRPDR(u1,CEO\_2,({(ES\_Engineer\_2,{At\_office}),Tablet\_Device}))

revokeRPDR(u1,CEO\_2,({(ES\_Engineer\_2,{At\_office}),Fitness\_Device}))

revokeRPDR(u1,CEO\_2,({(ES\_Engineer\_2,{At\_office}),Garage\_Device}))

revokeRPDR(u1,CEO\_2,({(ES\_Engineer\_2,{At\_office}),Wifi\_Device}))

revokeRPDR(u1,CEO\_2,({(ES\_Engineer\_2,{At\_office}),Lighting\_Device}))

revokeRPDR(u1,CEO\_2,({(ES\_Engineer\_2,{At\_office}),Work\_Device}))

revokeRPDR(u1,CEO\_2,({(ES\_Engineer\_2,{At\_office}),Common\_Device}))

**First building**

revokeRPDR(u1,CEO\_1,({(IT\_1,{At\_office}),Entertainment\_Device}))

revokeRPDR(u1,CEO\_1,({(IT\_1,{At\_office}),Door\_Device}))

revokeRPDR(u1,CEO\_1,({(IT\_1,{At\_office}),Computer\_Device}))

revokeRPDR(u1,CEO\_1,({(IT\_1,{At\_office}),Tablet\_Device}))

revokeRPDR(u1,CEO\_1,({(IT\_1,{At\_office}),Fitness\_Device}))

revokeRPDR(u1,CEO\_1,({(IT\_1,{At\_office}),Garage\_Device}))

revokeRPDR(u1,CEO\_1,({(IT\_1,{At\_office}),Wifi\_Device}))

revokeRPDR(u1,CEO\_1,({(IT\_1,{At\_office}),Lighting\_Device}))

revokeRPDR(u1,CEO\_1,({(IT\_1,{At\_office}),Work\_Device}))

revokeRPDR(u1,CEO\_1,({(IT\_1,{At\_office}),Common\_Device}))

**Second building**

revokeRPDR(u1,CEO\_2,({(IT\_2,{At\_office}),Entertainment\_Device}))

revokeRPDR(u1,CEO\_2,({(IT\_2,{At\_office}),Door\_Device}))

revokeRPDR(u1,CEO\_2,({(IT\_2,{At\_office}),Computer\_Device}))

revokeRPDR(u1,CEO\_2,({(IT\_2,{At\_office}),Tablet\_Device}))

revokeRPDR(u1,CEO\_2,({(IT\_2,{At\_office}),Fitness\_Device}))

revokeRPDR(u1,CEO\_2,({(IT\_2,{At\_office}),Garage\_Device}))

revokeRPDR(u1,CEO\_2,({(IT\_2,{At\_office}),Wifi\_Device}))

revokeRPDR(u1,CEO\_2,({(IT\_2,{At\_office}),Lighting\_Device}))

revokeRPDR(u1,CEO\_2,({(IT\_2,{At\_office}),Work\_Device}))

revokeRPDR(u1,CEO\_2,({(IT\_2,{At\_office}),Common\_Device}))

**First building**

revokeRPDR(u1,CEO\_1,({(HR\_Manager\_1,{At\_office}),Entertainment\_Device}))

revokeRPDR(u1,CEO\_1,({(HR\_Manager\_1,{At\_office}),Door\_Device}))

revokeRPDR(u1,CEO\_1,({(HR\_Manager\_1,{At\_office}),Safe\_Device}))

revokeRPDR(u1,CEO\_1,({(HR\_Manager\_1,{At\_office}),Computer\_Device}))

revokeRPDR(u1,CEO\_1,({(HR\_Manager\_1,{At\_office}),Tablet\_Device}))

revokeRPDR(u1,CEO\_1,({(HR\_Manager\_1,{At\_office}),Fitness\_Device}))

revokeRPDR(u1,CEO\_1,({(HR\_Manager\_1,{At\_office}),Garage\_Device}))

revokeRPDR(u1,CEO\_1,({(HR\_Manager\_1,{At\_office}),Wifi\_Device}))

revokeRPDR(u1,CEO\_1,({(HR\_Manager\_1,{At\_office}),Lighting\_Device}))

revokeRPDR(u1,CEO\_1,({(HR\_Manager\_1,{At\_office}),Work\_Device}))

revokeRPDR(u1,CEO\_1,({(HR\_Manager\_1,{At\_office}),Common\_Device}))

revokeRPDR(u1,CEO\_1,({(HR\_Manager\_1,{At\_office}),Biometric\_Device}))

**Second building**

revokeRPDR(u1,CEO\_2,({(HR\_Manager\_2,{At\_office}),Entertainment\_Device}))

revokeRPDR(u1,CEO\_2,({(HR\_Manager\_2,{At\_office}),Door\_Device}))

revokeRPDR(u1,CEO\_2,({(HR\_Manager\_2,{At\_office}),Safe\_Device}))

revokeRPDR(u1,CEO\_2,({(HR\_Manager\_2,{At\_office}),Computer\_Device}))

revokeRPDR(u1,CEO\_2,({(HR\_Manager\_2,{At\_office}),Tablet\_Device}))

revokeRPDR(u1,CEO\_2,({(HR\_Manager\_2,{At\_office}),Fitness\_Device}))

revokeRPDR(u1,CEO\_2,({(HR\_Manager\_2,{At\_office}),Garage\_Device}))

revokeRPDR(u1,CEO\_2,({(HR\_Manager\_2,{At\_office}),Wifi\_Device}))

revokeRPDR(u1,CEO\_2,({(HR\_Manager\_2,{At\_office}),Lighting\_Device}))

revokeRPDR(u1,CEO\_2,({(HR\_Manager\_2,{At\_office}),Work\_Device}))

revokeRPDR(u1,CEO\_2,({(HR\_Manager\_2,{At\_office}),Common\_Device}))

revokeRPDR(u1,CEO\_2,({(HR\_Manager\_2,{At\_office}),Biometric\_Device}))

**First building**

revokeRPDR(u1,CEO\_1,({(Adm\_empl\_1,{At\_office}),Entertainment\_Device}))

revokeRPDR(u1,CEO\_1,({(Adm\_empl\_1,{At\_office}),Door\_Device}))

revokeRPDR(u1,CEO\_1,({(Adm\_empl\_1,{At\_office}),Safe\_Device}))

revokeRPDR(u1,CEO\_1,({(Adm\_empl\_1,{At\_office}),Computer\_Device}))

revokeRPDR(u1,CEO\_1,({(Adm\_empl\_1,{At\_office}),Tablet\_Device}))

revokeRPDR(u1,CEO\_1,({(Adm\_empl\_1,{At\_office}),Fitness\_Device}))

revokeRPDR(u1,CEO\_1,({(Adm\_empl\_1,{At\_office}),Garage\_Device}))

revokeRPDR(u1,CEO\_1,({(Adm\_empl\_1,{At\_office}),Wifi\_Device}))

revokeRPDR(u1,CEO\_1,({(Adm\_empl\_1,{At\_office}),Lighting\_Device}))

revokeRPDR(u1,CEO\_1,({(Adm\_empl\_1,{At\_office}),Work\_Device}))

revokeRPDR(u1,CEO\_1,({(Adm\_empl\_1,{At\_office}),Common\_Device}))

revokeRPDR(u1,CEO\_1,({(Adm\_empl\_1,{At\_office}),Biometric\_Device}))

**Second building**

revokeRPDR(u1,CEO\_2,({(Adm\_empl\_2,{At\_office}),Entertainment\_Device}))

revokeRPDR(u1,CEO\_2,({(Adm\_empl\_2,{At\_office}),Door\_Device}))

revokeRPDR(u1,CEO\_2,({(Adm\_empl\_2,{At\_office}),Safe\_Device}))

revokeRPDR(u1,CEO\_2,({(Adm\_empl\_2,{At\_office}),Computer\_Device}))

revokeRPDR(u1,CEO\_2,({(Adm\_empl\_2,{At\_office}),Tablet\_Device}))

revokeRPDR(u1,CEO\_2,({(Adm\_empl\_2,{At\_office}),Fitness\_Device}))

revokeRPDR(u1,CEO\_2,({(Adm\_empl\_2,{At\_office}),Garage\_Device}))

revokeRPDR(u1,CEO\_2,({(Adm\_empl\_2,{At\_office}),Wifi\_Device}))

revokeRPDR(u1,CEO\_2,({(Adm\_empl\_2,{At\_office}),Lighting\_Device}))

revokeRPDR(u1,CEO\_2,({(Adm\_empl\_2,{At\_office}),Work\_Device}))

revokeRPDR(u1,CEO\_2,({(Adm\_empl\_2,{At\_office}),Common\_Device}))

revokeRPDR(u1,CEO\_2,({(Adm\_empl\_2,{At\_office}),Biometric\_Device}))

**First building**

revokeRPDR(u1,CEO\_1,({(Receptionist\_1,{At\_office}),Entertainment\_Device}))

revokeRPDR(u1,CEO\_1,({(Receptionist\_1,{At\_office}),Door\_Device}))

revokeRPDR(u1,CEO\_1,({(Receptionist\_1,{At\_office}),Computer\_Device}))

revokeRPDR(u1,CEO\_1,({(Receptionist\_1,{Any\_Time}),Tablet\_Device}))

revokeRPDR(u1,CEO\_1,({(Receptionist\_1,{At\_office}),Fitness\_Device}))

revokeRPDR(u1,CEO\_1,({(Receptionist\_1,{At\_office}),Garage\_Device}))

revokeRPDR(u1,CEO\_1,({(Receptionist\_1,{At\_office}),Wifi\_Device}))

revokeRPDR(u1,CEO\_1,({(Receptionist\_1,{Any\_Time}),Monitor\_Device}))

revokeRPDR(u1,CEO\_1,({(Receptionist\_1,{At\_office}),Lighting\_Device}))

revokeRPDR(u1,CEO\_1,({(Receptionist\_1,{Any\_Time}),Work\_Device}))

revokeRPDR(u1,CEO\_1,({(Receptionist\_1,{At\_office}),Common\_Device}))

**Second building**

revokeRPDR(u1,CEO\_2,({(Receptionist\_2,{At\_office}),Entertainment\_Device}))

revokeRPDR(u1,CEO\_2,({(Receptionist\_2,{At\_office}),Door\_Device}))

revokeRPDR(u1,CEO\_2,({(Receptionist\_2,{At\_office}),Computer\_Device}))

revokeRPDR(u1,CEO\_2,({(Receptionist\_2,{Any\_Time}),Tablet\_Device}))

revokeRPDR(u1,CEO\_2,({(Receptionist\_2,{At\_office}),Fitness\_Device}))

revokeRPDR(u1,CEO\_2,({(Receptionist\_2,{At\_office}),Garage\_Device}))

revokeRPDR(u1,CEO\_2,({(Receptionist\_2,{At\_office}),Wifi\_Device}))

revokeRPDR(u1,CEO\_2,({(Receptionist\_2,{Any\_Time}),Monitor\_Device}))

revokeRPDR(u1,CEO\_2,({(Receptionist\_2,{At\_office}),Lighting\_Device}))

revokeRPDR(u1,CEO\_2,({(Receptionist\_2,{Any\_Time}),Work\_Device}))

revokeRPDR(u1,CEO\_2,({(Receptionist\_2,{At\_office}),Common\_Device}))

**First building**

revokeRPDR(u2,RPS\_1,({(Waiter\_1,{At\_office}),Door\_Device}))

revokeRPDR(u2,RPS\_1,({(Waiter\_1,{At\_office}),Tablet\_Device}))

revokeRPDR(u2,RPS\_1,({(Waiter\_1,{At\_office}),Fitness\_Device}))

revokeRPDR(u2,RPS\_1,({(Waiter\_1,{At\_office}),Garage\_Device}))

revokeRPDR(u2,RPS\_1,({(Waiter\_1,{At\_office}),Wifi\_Device}))

revokeRPDR(u2,RPS\_1,({(Waiter\_1,{Any\_Time}),Kitchen\_Device}))

revokeRPDR(u2,RPS\_1,({(Waiter\_1,{At\_office}),Monitor\_Device}))

revokeRPDR(u2,RPS\_1,({(Waiter\_1,{At\_office}),Lighting\_Device}))

revokeRPDR(u2,RPS\_1,({(Waiter\_1,{At\_office}),Common\_Device}))

**Second building**

revokeRPDR(u2,RPS\_2,({(Waiter\_2,{At\_office}),Door\_Device}))

revokeRPDR(u2,RPS\_2,({(Waiter\_2,{At\_office}),Tablet\_Device}))

revokeRPDR(u2,RPS\_2,({(Waiter\_2,{At\_office}),Fitness\_Device}))

revokeRPDR(u2,RPS\_2,({(Waiter\_2,{At\_office}),Garage\_Device}))

revokeRPDR(u2,RPS\_2,({(Waiter\_2,{At\_office}),Wifi\_Device}))

revokeRPDR(u2,RPS\_2,({(Waiter\_2,{Any\_Time}),Kitchen\_Device}))

revokeRPDR(u2,RPS\_2,({(Waiter\_2,{At\_office}),Monitor\_Device}))

revokeRPDR(u2,RPS\_2,({(Waiter\_2,{At\_office}),Lighting\_Device}))

revokeRPDR(u2,RPS\_2,({(Waiter\_2,{At\_office}),Common\_Device}))

**First building**

revokeRPDR(u2,RPS\_1,({(PT\_1,{At\_office}),Door\_Device}))

revokeRPDR(u2,RPS\_1,({(PT\_1,{At\_office}),Tablet\_Device}))

revokeRPDR(u2,RPS\_1,({(PT\_1,{At\_office}),Fitness\_Device}))

revokeRPDR(u2,RPS\_1,({(PT\_1,{At\_office}),Garage\_Device}))

revokeRPDR(u2,RPS\_1,({(PT\_1,{At\_office}),Wifi\_Device}))

revokeRPDR(u2,RPS\_1,({(PT\_1,{At\_office}),Monitor\_Device}))

revokeRPDR(u2,RPS\_1,({(PT\_1,{At\_office}),Lighting\_Device}))

revokeRPDR(u2,RPS\_1,({(PT\_1,{At\_office}),Common\_Device}))

revokeRPDR(u2,RPS\_1,({(PT\_1,{At\_office}),Fitness\_PT\_Device}))

**Second building**

revokeRPDR(u2,RPS\_2,({(PT\_2,{At\_office}),Door\_Device}))

revokeRPDR(u2,RPS\_2,({(PT\_2,{At\_office}),Tablet\_Device}))

revokeRPDR(u2,RPS\_2,({(PT\_2,{At\_office}),Fitness\_Device}))

revokeRPDR(u2,RPS\_2,({(PT\_2,{At\_office}),Garage\_Device}))

revokeRPDR(u2,RPS\_2,({(PT\_2,{At\_office}),Wifi\_Device}))

revokeRPDR(u2,RPS\_2,({(PT\_2,{At\_office}),Monitor\_Device}))

revokeRPDR(u2,RPS\_2,({(PT\_2,{At\_office}),Lighting\_Device}))

revokeRPDR(u2,RPS\_2,({(PT\_2,{At\_office}),Common\_Device}))

revokeRPDR(u2,RPS\_2,({(PT\_2,{At\_office}),Fitness\_PT\_Device}))

**First building**

revokeRPDR(u2,RPS\_1,({(Gym\_client\_1,{Any\_Time}),Door\_Device}))

revokeRPDR(u2,RPS\_1,({(Gym\_client\_1,{Any\_Time}),Tablet\_Devices}))

revokeRPDR(u2,RPS\_1,({(Gym\_client\_1,{Any\_Time}),Fitness\_Devices}))

revokeRPDR(u2,RPS\_1,({(Gym\_client\_1,{Any\_Time}),Garage\_Device}))

revokeRPDR(u2,RPS\_1,({(Gym\_client\_1,{Any\_Time}),Wifi\_Device}))

revokeRPDR(u2,RPS\_1,({(Gym\_client\_1,{Any\_Time}),Lighting\_Devices}))

revokeRPDR(u2,RPS\_1,({(Gym\_client\_1,{Any\_Time}),Common\_Devices}))

**Second building**

revokeRPDR(u2,RPS\_2,({(Gym\_client\_2,{Any\_Time}),Door\_Device}))

revokeRPDR(u2,RPS\_2,({(Gym\_client\_2,{Any\_Time}),Tablet\_Devices}))

revokeRPDR(u2,RPS\_2,({(Gym\_client\_2,{Any\_Time}),Fitness\_Devices}))

revokeRPDR(u2,RPS\_2,({(Gym\_client\_2,{Any\_Time}),Garage\_Device}))

revokeRPDR(u2,RPS\_2,({(Gym\_client\_2,{Any\_Time}),Wifi\_Device}))

revokeRPDR(u2,RPS\_2,({(Gym\_client\_2,{Any\_Time}),Lighting\_Devices}))

revokeRPDR(u2,RPS\_2,({(Gym\_client\_2,{Any\_Time}),Common\_Devices}))

**First building**

revokeRPDR(u2,RPS\_1,({(Chef\_1,{At\_Office}),Door\_Device}))

revokeRPDR(u2,RPS\_1,({(Chef\_1,{At\_Office}),Tablet\_Devices}))

revokeRPDR(u2,RPS\_1,({(Chef\_1,{At\_Office}),Fitness\_Devices}))

revokeRPDR(u2,RPS\_1,({(Chef\_1,{At\_Office}),Garage\_Device}))

revokeRPDR(u2,RPS\_1,({(Chef\_1,{At\_Office}),Wifi\_Device}))

revokeRPDR(u2,RPS\_1,({(Chef\_1,{At\_Office}),Kitchen\_Devices}))

revokeRPDR(u2,RPS\_1,({(Chef\_1,{At\_Office}),Monitor\_Device}))

revokeRPDR(u2,RPS\_1,({(Chef\_1,{At\_Office}),Lighting\_Devices}))

revokeRPDR(u2,RPS\_1,({(Chef\_1,{At\_Office}),Common\_Devices}))

**second building**

revokeRPDR(u2,RPS\_2,({(Chef\_2,{At\_Office}),Door\_Device}))

revokeRPDR(u2,RPS\_2,({(Chef\_2,{At\_Office}),Tablet\_Devices}))

revokeRPDR(u2,RPS\_2,({(Chef\_2,{At\_Office}),Fitness\_Devices}))

revokeRPDR(u2,RPS\_2,({(Chef\_2,{At\_Office}),Garage\_Device}))

revokeRPDR(u2,RPS\_2,({(Chef\_2,{At\_Office}),Wifi\_Device}))

revokeRPDR(u2,RPS\_2,({(Chef\_2,{At\_Office}),Kitchen\_Devices}))

revokeRPDR(u2,RPS\_2,({(Chef\_2,{At\_Office}),Monitor\_Device}))

revokeRPDR(u2,RPS\_2,({(Chef\_2,{At\_Office}),Lighting\_Devices}))

revokeRPDR(u2,RPS\_2,({(Chef\_2,{At\_Office}),Common\_Devices}))

**First building**

revokeRPDR(u2,RPS\_1,({(Guest\_1,{At\_office}),Common\_Device}))

**Second building**

revokeRPDR(u2,RPS\_2,({(Guest\_2,{At\_office}),Common\_Device}))

**First building**

revokeRPDR(u1,CEO\_1,({(Vigilant\_1,{Any\_Time}),Door\_Device}))

revokeRPDR(u1,CEO\_1,({(Vigilant\_1,{Any\_Time}),Advanced\_Device}))

revokeRPDR(u1,CEO\_1,({(Vigilant\_1,{Any\_Time}),Computer\_Device}))

revokeRPDR(u1,CEO\_1,({(Vigilant\_1,{Any\_Time}),Fitness\_Devices}))

revokeRPDR(u1,CEO\_1,({(Vigilant\_1,{Any\_Time}),Garage\_Device}))

revokeRPDR(u1,CEO\_1,({(Vigilant\_1,{Any\_Time}),Wifi\_Device}))

revokeRPDR(u1,CEO\_1,({(Vigilant\_1,{Any\_Time}),Security\_Device}))

revokeRPDR(u1,CEO\_1,({(Vigilant\_1,{Any\_Time}),Lighting\_Devices}))

revokeRPDR(u1,CEO\_1,({(Vigilant\_1,{Any\_Time}),Common\_Devices}))

**Second building**

revokeRPDR(u1,CEO\_2,({(Vigilant\_2,{Any\_Time}),Door\_Device}))

revokeRPDR(u1,CEO\_2,({(Vigilant\_2,{Any\_Time}),Advanced\_Device}))

revokeRPDR(u1,CEO\_2,({(Vigilant\_2,{Any\_Time}),Computer\_Device}))

revokeRPDR(u1,CEO\_2,({(Vigilant\_2,{Any\_Time}),Fitness\_Devices}))

revokeRPDR(u1,CEO\_2,({(Vigilant\_2,{Any\_Time}),Garage\_Device}))

revokeRPDR(u1,CEO\_2,({(Vigilant\_2,{Any\_Time}),Wifi\_Device}))

revokeRPDR(u1,CEO\_2,({(Vigilant\_2,{Any\_Time}),Security\_Device}))

revokeRPDR(u1,CEO\_2,({(Vigilant\_2,{Any\_Time}),Lighting\_Devices}))

revokeRPDR(u1,CEO\_2,({(Vigilant\_2,{Any\_Time}),Common\_Devices}))

**First building**

revokeRPDR(u2,RPS\_1,({(cleaner,{At\_office}),Door\_Device}))

revokeRPDR(u2,RPS\_1,({(cleaner,{At\_office}),Garage\_Device}))

revokeRPDR(u2,RPS\_1,({(cleaner,{At\_office}),Wifi\_Device}))

revokeRPDR(u2,RPS\_1,({(cleaner,{At\_office}),Lighting\_Device}))

revokeRPDR(u2,RPS\_1,({(cleaner,{At\_office}),Common\_Device}))

**Second building**

revokeRPDR(u2,RPS\_2,({(cleaner,{At\_office}),Door\_Device}))

revokeRPDR(u2,RPS\_2,({(cleaner,{At\_office}),Garage\_Device}))

revokeRPDR(u2,RPS\_2,({(cleaner,{At\_office}),Wifi\_Device}))

revokeRPDR(u2,RPS\_2,({(cleaner,{At\_office}),Lighting\_Device}))

revokeRPDR(u2,RPS\_2,({(cleaner,{At\_office}),Common\_Device}))

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**SAMPLE ANALYSIS QUESTIONS**

During the experimentation phase, we observed some significant findings, particularly as four experiments were outlined.

It was run the tool in 3 different ways, identifying them as case 1, case 2, and case 3.

As for case 1, we used VAC in the classical way, testing the whole policy with all users and with the SPEC r option, in our case SPEC target.

From the following, it was noticed that in this context VAC does not scale because too many configurations are created.

For example, if the role is unreachable, not even after 1 hour the tool provided results.

Hence case 2 and case 3 arise.

Specifically, in case 2 we test the entire policy with all users, but use the SPEC user u and role r option.

In case 3, we adjust the policy by removing users that are not part of the role's reachability query, leaving only the user to be tested with the query in question and using the SPEC target option.

* Can CEO\_1 control Entratteniment\_Device?

Yes, according to the policy rules, Chief Executive Officer has access to entertainment devices.

* Can Gym\_client\_2 control Fitness\_PT\_device?

No, according to the policy rules, gym clients do not have access to the personal trainer's fitness devices such as his tablet.

* Can Guest\_2 control Common\_Device?

Yes, according to the policy rules, Guest\_2 has access to common devices such as doors and lights.

* Can RPS\_1 control Fitness\_device?

Yes, according to the policy rules, Responsible for Physical Security has access to fitness devices such as Containing smart equipment for gym training.

* Can adm\_empl\_2 control Security\_device?

No, according to the rules of the rules, such access is granted to other roles.

* Can Vigilant\_1 control Security\_device?

Yes, according to the policy rules, administrative employee has access to security devices containing videosurvellaince cameras.

* Can Vigilant\_1 control Kitchen\_device?

No, according to the policy rules, vigilant do not has access to the kitchen devices. This access is granted to the chef.

* Can Guest\_1 control pc\_01?

No according to the policy, the guest does not have access to the device computers that contain the CEO\_01's pc\_01

* Can Cleaner\_1 control kitchen oven on a Kitchen\_device?

No, because according to the rules of the policy, access is reserved exclusively for the chef.

* Can adm\_empl\_2 access safe\_room7?

yes, according to policy rules, access to safes was established for this role.

* Can Ceo\_1 access DoorLock\_01?

Yes, according to the policy rules, this role has access to common\_devices containing ports as well.

* Can IT\_2 access SurveillanceCameras\_parking\_2?

No, according to policy rules, Information technician does not have access to security device containing cameras.

* Can Vigilant\_1 access SurveillanceCameras\_secondfloorcorridor\_1?

Yes, according to the policy rules, the vigilante has access to the surveillance cameras.

* Can Vigilant\_2 have access to SmokeAlarm\_07?

Yes, according to the policy rules, the vigilante has access to the devices contained in security device, including smoke alarm.

* Can HR\_Manager\_2 access safe\_room7?

No, according to the policy rules, such a room is accessible from other roles as well as from admin employee.

* Can Chef\_1 access Monitor\_cateen\_1?

Yes, according to the policy rules, the chef has access to the monitor for consulting reservations, recipes, etc.

* Can Chef\_2 access 1Monitor\_ videosurveillance\_2?

No, according to the rules of poitics, access to video surveillance cameras are only accessible to vigilantes.

* Can Chef\_2 access SmartCookware&Cooktop\_2?

Yes, according to policy rules, the chef can access kitchen device containing SmartCookware&Cooktop\_2.

* Can Cleaner\_1 access 1Tablet\_waiter\_1?

No, cleaner non può accedere ai tablet device contenenti i tablet ma solo a common device e cleaner device.

* Can Cleaner\_2 get access to pc\_74?

No, according to policy rules, clearner cannot access Computer devices, but others such as common devices and cleaning devices containing smart devices for clearing.

* Gym\_clients\_2 can access tapirulan\_smart\_2?

Yes, according to the rules of the policy, Gym clients have access to Fitness device containing smart workout equipment.

* Can RPS\_1 access pc\_02?

Yes, according to policy rules, the Responsible for Physical Security has access to pc devices containing his pc\_02.