

INSTALATION AND TESTING OF TECHNICAL DEVICES AND APPLICATIONS

Deliverable D.T3.4.4

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1. Introduction

This document, Instalation and testing of technical devices and applications, presents the procedure of putting the AP-NURSE devices in operation in the Social Care Home in Warsaw as part of Output O.T3.3 - Pilot testing of AP-NURSE - persons suffering from Alzheimer´s disease in Social Care Home in Warsaw” and deliverable D.T3.3.4. It starts with the selection of devices, including the AP-NURSE Home, AP-NURSE Care M5stack and AP-NURSE Care Waspnote platforms, based on the specification and map provided by the representatives of Social Care Home Warsaw operated as part of the Alzheimer Center. The next chapters are dealing with the detailed procedures of deploying and instaling the AP-NURSE devices in dedicated locations and with the testing of the functionality of the installed devices. The last chapter is dealing with the registration of the installed devices to the Information System, assignment of devices to specific collections, configuration of notifications and testing the functionality of the whole system.

2. Selection of devices for testing

The pilot testing in Social Care Home Warsaw is focused on monitoring the patients suffering from Alzheimer´s disease. The Social Care Home in Warsaw is operated by the City of Warsaw as part of the Alzheimer Centre, located in the Aleja Wilanowska street in Warsaw. The map of the Alzheimer Centre is shown in **Figure 1**. The Center is in an enclosed area consisting of the administration building, the Day Care Centre, two buildings of the Social Care Home and a park. The pilot testing of AP-NURSE devices is performed in building 1 of the Social Care Home (SCH). The building is in a controlled area and is connected to the park and the administration building through two corridors (main and side) with doors allowing passage of authorized personnel only. The map of the controled zone is shown in **Figure 2**.



Figure 1. Map of the Alzheimer Centre

2.1. Areas of the Social Care Home

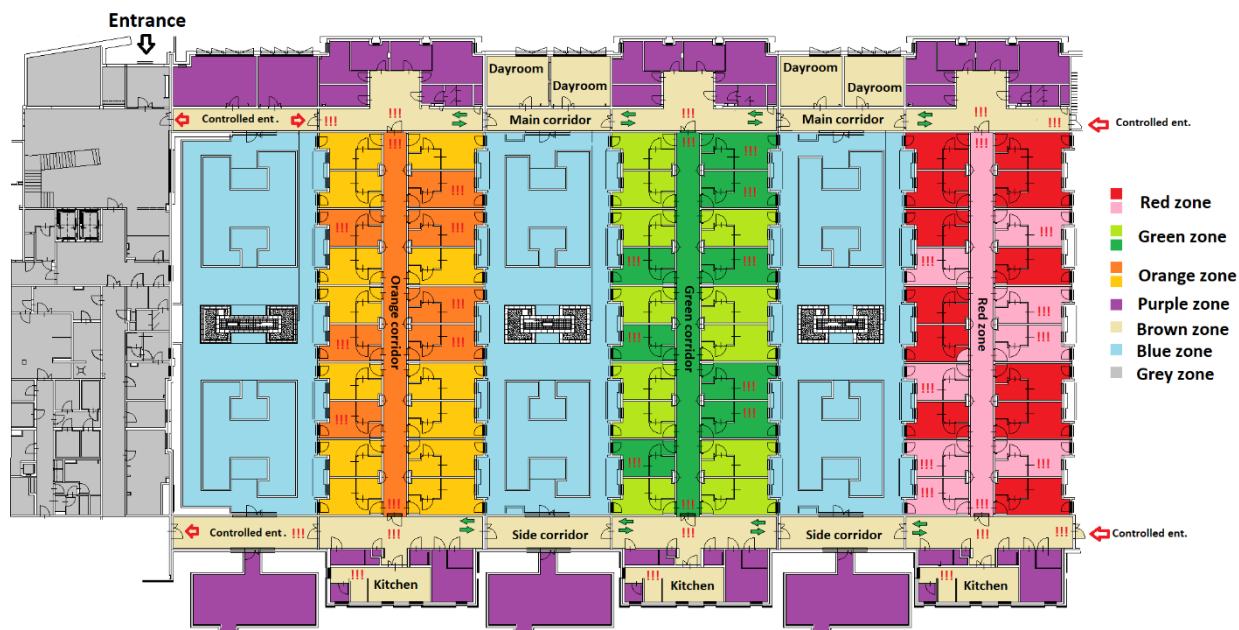


Figure 2. Layout of the controlled area to be monitored

The controlled area consists of the following sub-areas:

- Orange
 - Patients rooms
 - 10 double rooms
 - 10 single rooms
 - Orange corridor
- Green
 - Patients rooms
 - 10 double rooms
 - 10 single rooms
 - Green corridor
- Red
 - Patients rooms
 - 10 double rooms
 - 10 single rooms
 - Red corridor
- Purple
 - Caregivers area
 - Areas primary dedicated to caregivers



- Patients may be present in some cases, but their free passage is not allowed
- Caregivers room, toilet, laundry, washroom, warehouse, maintenance area, smoking room
- **Brown**
 - Common areas of patients
 - Main corridor
 - Side corridor
 - Dayroom
 - Kitchen
 - Toilets
 - Area where the movement of patients/clients is not limited during the day
 - Both patients/clients and caregivers may be present
- **Blue**
 - Garden
 - Outside premises available for patients after permission
 - Doors from patients room (closed during night time)
 - Doors from the main and the side corridor
 - Opened by caregivers if necessary
- **Grey**
 - Administration building
 - Areas not accessible for patients
 - Controlled entry by magnetic cards
 - Opened by caregivers if necessary

2.2. Assignment of monitoring zones

Based on the above mentioned classification of areas and the regime of patients and caregivers in the Social Care Home, the following monitoring zones were defined:

- **Monitoring of patients in their rooms**
 - Orange zone
 - 7 rooms
 - monitoring of the patient in the bed or in the room
 - **AP1-M** - 5 devices
 - **AP1-W** - 2 devices
 - monitoring the exit to the garden (blue zone)
 - **AP2-M** - 4 devices with Hall effect sensors
 - Green zone



- 8 rooms
- monitoring of the patient in the bed
 - AP1-H - 2 devices
 - AP1-M - 3 devices
 - AP1-W - 3 devices
- monitoring the exit to the garden (blue zone)
 - AP2-M
 - 3 devices with Hall effect sensors
- Red zone
 - 7 rooms
 - monitoring of the patient in the bed or in the room or in the room
 - AP1-H - 7 devices
 - monitoring the exit to the garden (blue zone)
 - AP2-M - 6 devices with Time of flight (TOF) sensors
- **Monitoring of the intersections of corridors**
 - Orange corridor X main corridor
 - Monitoring of activity pattern during night
 - AP4-H - 1 device
 - Orange corridor X side corridor
 - Monitoring of activity pattern during night
 - AP4-H - 1 device
 - Green corridor X main corridor
 - Monitoring of activity pattern during night
 - AP4-H - 1 device
 - Green corridor X side corridor
 - Monitoring of activity pattern during night
 - AP4-H - 1 device
 - Red corridor X main corridor
 - Monitoring of activity pattern during night
 - AP4-H - 1 device
 - Red corridor X side corridor
 - Monitoring of activity pattern during night
 - AP4-H - 1 device
- **Monitoring the exits from the controlled area**



- Main corridor - orange exit
 - Monitoring of activity pattern during night
 - AP4-H - 1 device
- Main corridor - red exit
 - Monitoring of activity pattern during night
 - AP4-W - 1 device
- Side corridor - orange exit
 - Monitoring of activity pattern during night
 - AP4-H - 1 device
- Side corridor - red exit
 - Monitoring of activity pattern during night
 - AP4-M - 1 device
- **Monitoring of kitchens**
 - Orange zone
 - Monitoring of movement and gasses
 - AP4-W - 1 device
 - Green zone
 - Monitoring of movement and gasses
 - AP4-W - 1 device
 - Red zone
 - Monitoring of movement and gasses
 - AP4-W - 1 device

2.3. Devices used for deployment

Due to the complexity and diversity of premises in the SCH, all AP-NURSE platforms were selected for testing. The following section presents the used versions of AP-NURSE devices. **Figure 3 - Figure 11** present the pictures of the device and a configuration of sensors.

2.3.1. AP-NURSE Home

2.3.1.1. AP1-H



AP-NURSE version	Sensor configuration					
	Mov.	Bar.	Force	Gas	Temp.	Light
AP1-H						
AP2-H						
AP4-H						
AP6-H						
AP7-H						

Figure 3. AP1-H device and configuration of sensors

2.3.1.2. AP4-H



AP-NURSE version	Sensor configuration					
	Mov.	Bar.	Force	Gas	Temp.	Light
AP1-H						
AP2-H						
AP4-H						
AP6-H						
AP7-H						

Figure 4. AP4-H device with PIR movement sensor

2.3.2. AP-NURSE Care - M5stack

2.3.2.1. AP1-M



AP-NURSE version	Sensor configuration					
	Mov.	Bar.	Force	Gas	Temp.	Light
AP1-M						
AP2-M						
AP4-M						
AP6-M						

Figure 5. AP1-M device and configuration of sensors

2.3.2.2. AP2-M



AP-NURSE version	Sensor configuration					
	Mov.	Bar.	Force	Gas	Temp.	Light
AP1-M						
AP2-M						
AP4-M						
AP6-M						

Figure 6. AP2-M device with ToF sensor



AP-NURSE version	Sensor configuration					
	Mov.	Bar.	Force	Gas	Temp.	Light
AP1-M						
AP2-M						
AP4-M						
AP6-M						

Figure 7. AP2-M device with Hall effect sensor

2.3.2.3. AP4-M



AP-NURSE version	Sensor configuration					
	Mov.	Bar.	Force	Gas	Temp.	Light
AP1-M						
AP2-M						
AP4-M						
AP6-M						

Figure 8. AP4-M device with PIR movement sensor

2.3.3. AP-NURSE Home - Waspnote

2.3.3.1. AP1-W



AP-NURSE version	Sensor configuration						
	Mov.	Bar.	Force	Gas	Temp.	Light	Fall
AP1-W							
AP4-W							
AP6-W							
AP8-W							

Figure 9. AP1-W device and configuration of sensors

2.3.3.2. AP4-W



AP-NURSE version	Sensor configuration						
	Mov.	Bar.	Force	Gas	Temp.	Light	Fall
AP1-W							
AP4-W							
AP6-W							
AP8-W							

Figure 10. AP4-W device and configuration of sensors

2.3.3.3. AP6-W



AP-NURSE version	Sensor configuration						
	Mov.	Bar.	Force	Gas	Temp.	Light	Fall
AP1-W							
AP4-W							
AP6-W							
AP8-W							

Figure 11. AP4-W device and configuration of sensors

3. Deployment of AP-NURSE devices

Based on the created monitoring zones of the Social Care Home, the deployment of AP-NURSE devices was performed separately for each zone, i.e. Orange zone, Green zone, Red zone, Kitchens and Exits.

3.1. Orange zone

In the orange zone, the AP-NURSE devices were installed to monitor 7 rooms of patients and 2 doors leading to the orange corridor, from the main and the side corridor. In this zone, the AP1-M, AP1-W, AP2-M and AP4-H versions of AP-NURSE were installed. The summary of the installed devices can be found in **Table 1**.

In the case of patients' rooms, the table also provides information about the accommodated patients in the room. When it was possible and the WiFi connection was sufficient (optimized with the SCH personell), two AP-NURSE devices were installed:

- AP1-M or AP1-W to monitor the bed or the presence of the patients in the room
- AP2-M to monitor the balcony door.

In the case of double rooms, the AP1 devices were installed under one of the patient's beds. This device monitor movement of both patients since the beds are situated next to each other and the PIR movement sensor is aimed at the space between the beds. A combination of alerts from the FSR pressure sensors and PIR sensors may help to identify the patients, who move in the room. The AP2-M devices were directly attached to the balcony door and utilize hall effect sensors, which respond to the opening of the door. The AP4-H devices are placed above the door from the orange to the main and the side corridor to provide alerts if patients leave their room and start to wander in the center.

The map of AP-NURSE devices installed in the orange zone is shown in **Figure 12**. According to **Table 1**, OCM stands for the door between the main and the orange corridors and OCS for the door between the orange and the side corridors. The AP1-M and AP1-W devices are shown in blue, the AP2-M in purple and the AP4-H in yellow color. The AP-NURSE devices are presented using their shortcut, following the logic that 1M2 stands for the AP1-M-002 device.

Table 1. Summary of AP-NURSE devices installed in the orange zone

Room ID	Locaiton in the room	Gender / age	Characteristics of the monitored patient	Primary AP - NURSE unit	Secondary AP - NURSE unit
G/018	Under the bed (window)	F/86	Alzheimer's disease - walking	AP1-M-002 (1M2)	-
	Under the bed (wall)	F/75	Alzheimer's disease - walking	-	-
	Attached to the balcony door	-	-	-	AP2-M-012 (2M12)
G/020	Under the bed (window)	F/74	Alzheimer's disease - walking	-	-
	Under the bed (wall)	F/77	Alzheimer's disease - walking	AP1-M-008 (AM8)	-
	Attached to the balcony door	-	-	-	AP2-M-019 (2M19)



G/021	Under the bed (wall)	M/67	Dementia - walking	AP1-M-006 (1M6)	-
	Attached to the balcony door	-	-	-	AP2-M-018 (2M18)
G/026	Under the bed (window)	F/67	Alzheimer's disease - walking	-	-
	Under the bed (wall)	F/86	Alzheimer's disease - walking	AP1-M-009 (1M9)	-
	Attached to the balcony door	-	-	-	AP2-M-016 (2M16)
G/030	Under the bed (window)	M/78	Dementia - walking	-	-
	Under the bed (wall)	M/65	Alzheimer's disease - walking	AP1-W-003 (1W3)	-
	Attached to the balcony door	-	-	-	-
G/031	Under the bed (wall)	F/63	Dementia, mental problems - walking	AP1-W-002 (1W2)	-
G/037	Under the bed (wall)	M/76	Alzheimer's disease - walking	AP1-M-007 (1M7)	-
OCM	Above the door from the orange to the main corridor	N/A	Multiple patients and caregivers	AP4-H-005 (4H5)	-
OCS	Above the door from the orange to the side corridor	N/A	Multiple patients and caregivers	AP4-H-009 (4H9)	-

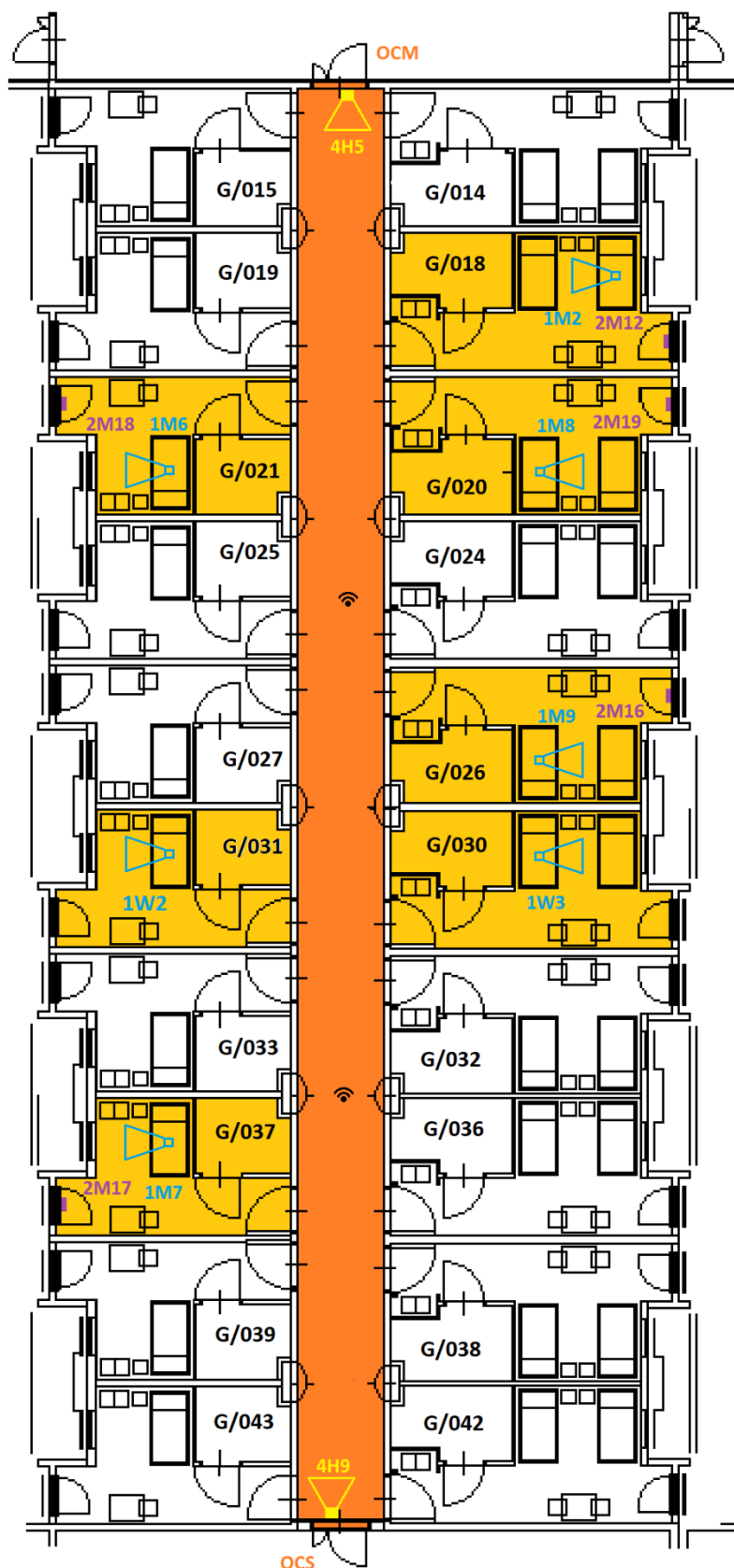


Figure 12. Map od of AP-NURSE devices installed in the orange zone

3.2. Green zone

The AP-NURSE devices were installed to monitor 8 rooms of patients and 2 doors leading to the green corridor, from the main and the side corridor. In this zone, AP1-H, AP1-M, AP1-W, AP2-M and AP4-H versions of AP-NURSE were installed. The summary of the installed devices can be found in **Table 2**.

Similarly, as in the orange zone, the devices in patients' rooms were assigned to patients. When it was possible, two AP-NURSE devices were installed:

- AP1-H, AP1-M or AP1-W to monitor the bed or the presence of the patient in the room
- AP2-M to monitor the balcony door.

If the wifi connection was not strong enough for the AP2-M devices, a standalone AP1-H, AP1-M or AP1-W device was installed. In the case of double rooms, the AP1-H, AP1-M and AP1-W devices monitor movement of both patients. The AP2-M devices were either directly attached to the balcony door and utilize hall effect sensors, or installed on the wall in the proximity of the door and utilize ToF (time of flight) sensors. The AP4-H devices are placed above the door from the green to the main and the side corridor to provide alerts

if patients leave the green corridor. The map of AP-NURSE devices installed in the green zone is shown in

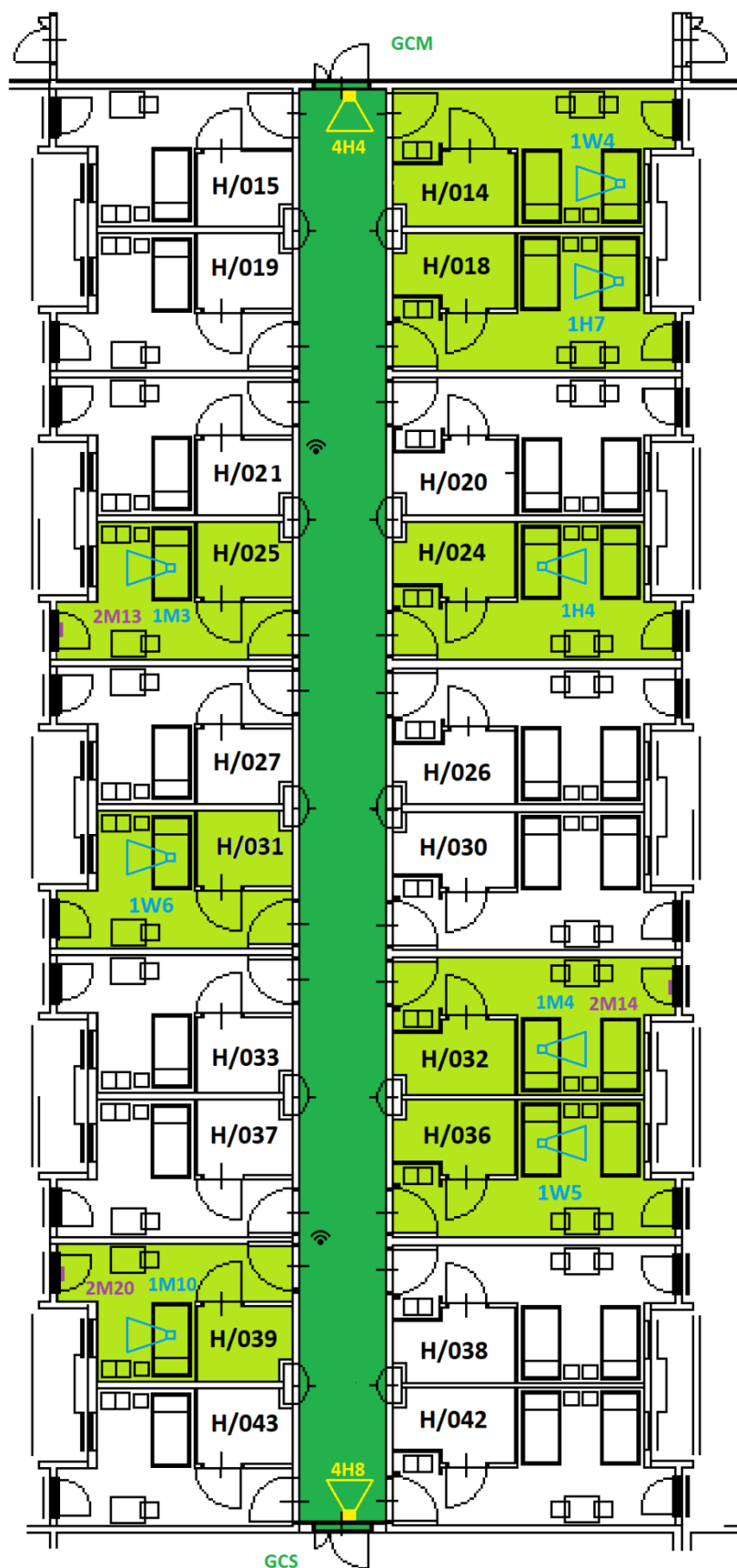


Figure 13. According to Table 2, GCM stands for the door between the main and the green corridors and GCS for the door between the green and the side corridors. The AP1-H, AP1-M and AP1-W devices are shown in blue, the AP2-M in purple and the AP4-H in yellow color. The devices are presented using their shortcut, following the logic that 1H7 stands for the AP1-H-007 device.

Table 2. Summary of AP-NURSE devices installed in the green zone

Room ID	Locaiton in the room	Gender / age	Characteristics of the monitored patient	Primary AP - NURSE unit	Secondary AP - NURSE unit
H/014	Under the bed (window)	M/71	Dementia - wheelchair	AP1-W-004 (1W4)	-
	Under the bed (wall)	M/80	Alzheimer's disease - walking	-	-
H/018	Under the bed (window)	F/90	Alzheimer's disease - walking	AP1-H-007 (1H7)	-
	Under the bed (wall)	F/85	Alzheimer's disease - wheelchair	-	-
	In front of the balcony door	-	-	-	-
H/024	Under the bed (window)	F/76	Alzheimer's disease - wheelchair	-	-
	Under the bed (wall)	F/78	Alzheimer's disease - wheelchair	AP1-H-004 (1H4)	-
	In front of the balcony door	-	-	-	-
H/025	Under the bed (wall)	F/87	Alzheimer's disease - walking	AP1-M-003 (1M3)	-
	Attached to the balcony door	-	-	-	AP2-M-013 (2M13)
H/031	Under the bed (wall)	F/78	Alzheimer's disease - walking	AP1-W-006 (1W6)	-
H/032	Under the bed (window)	F/93	Alzheimer's disease - walking	-	-
	Under the bed (wall)	F/83	Alzheimer's disease - walking	AP1-M-004 (1M4)	-
	Attached to the balcony door	-	-	-	AP2-M-014 (2M14)
H/036	Under the bed (window)	M/78	Alzheimer's disease - walking	-	-
	Under the bed (wall)	M/69	Alzheimer's disease - walking	AP1-W-005 (1W5)	-
	Attached to the balcony door	-	-	-	-



H/039	Under the bed (wall)	M/85	Alzheimer's disease - walking	AP1-M-010 (1M10)	-
	Attached to the balcony door	-	-	-	AP2-M-020 (2M20)
GCM	Above the door from the green to the main corridor	N/A	Multiple patients and caregivers	AP4-H-004 (4H4)	-
GCS	Above the door from the green to the side corridor	N/A	Multiple patients and caregivers	AP4-H-008 (4H8)	-

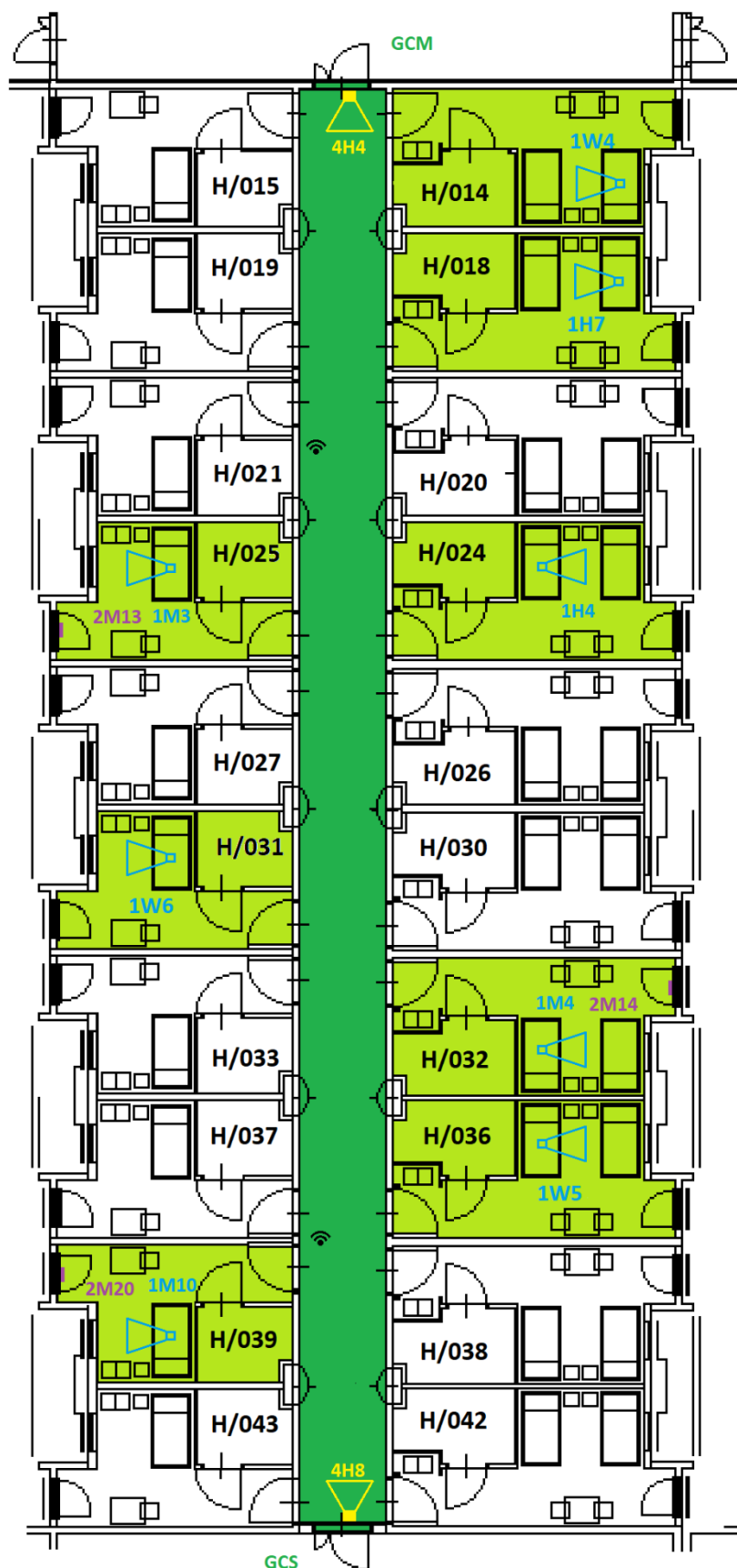


Figure 13. Map od of AP-NURSE devices installed in the green zone



3.3. Red zone

In the red zone, the AP-NURSE devices were installed to monitor 7 rooms of patients and 2 doors leading to the red corridor, from the main and the side corridor. In this zone, the AP1-H, AP2-M and AP4-H versions of AP-NURSE were installed. The summary of the installed devices can be found in **Table 3**.

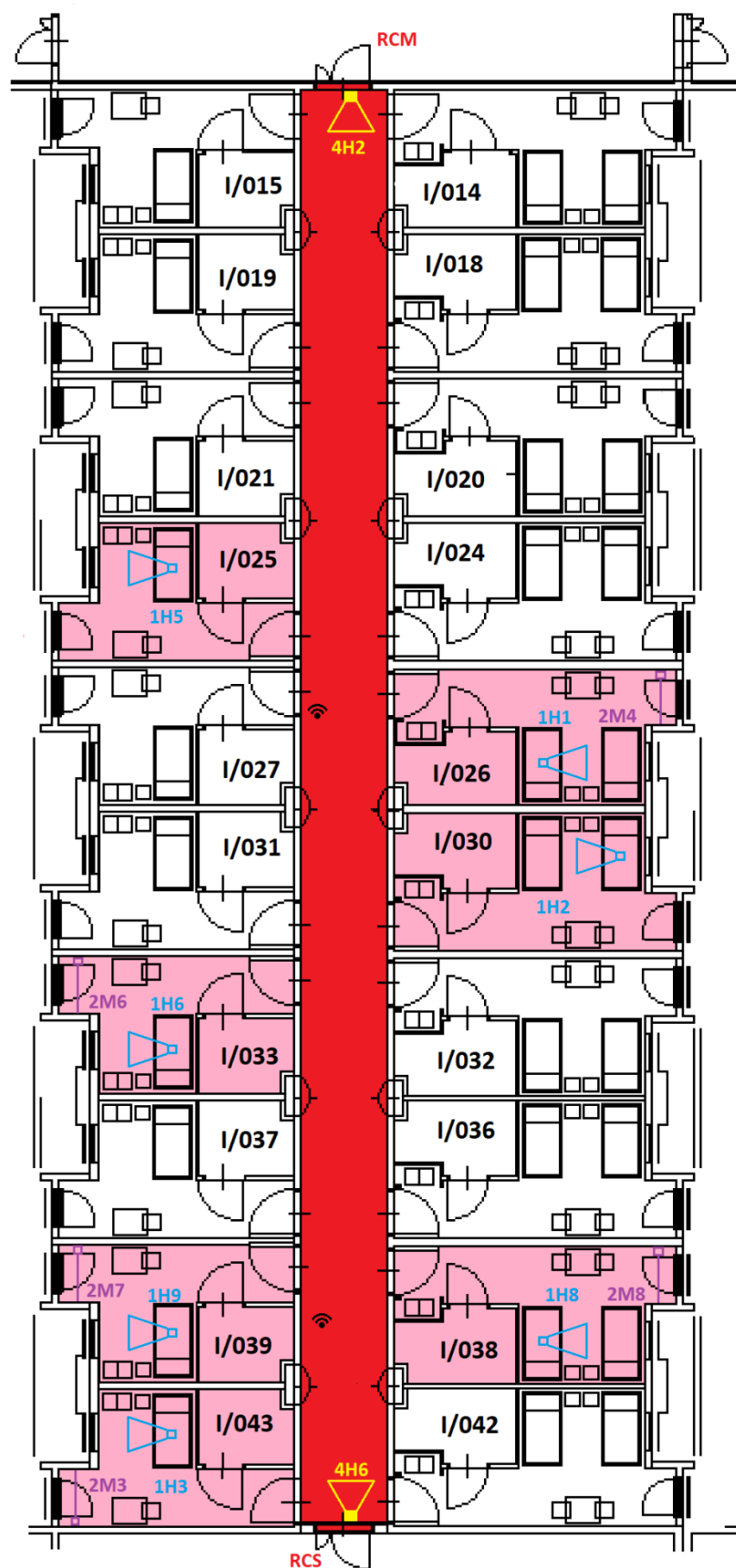
Similarly, as in the orange and green zone, the devices in patients' rooms were assigned to individual patients. When it was possible two AP-NURSE devices were installed:

- AP1-H to monitor the bed or the presence of the patient in the room
- AP2-M to monitor the balcony door.

If the wifi connection was not strong enough for the AP2-M devices, a standalone AP1-H device was installed.

In case of the double rooms, the AP1-H devices monitor motion of both patients. The AP2-M devices were installed on the wall in the proximity of the door and utilize ToF (time of flight) sensors. The AP4-H devices are placed above the doors connecting the corridors to the colored zones to provide alerts if patients leave

their room and start to wander in the center. The map of the AP-NURSE devices installed in the red zone



is shown in

Figure 14. According to **Table 3**, RCM stands for the door between the main and the red corridors and RCS for the door between the red and the side corridors. The AP1-H devices are shown in blue color, the AP2-M in purple color and the AP4-H in yellow color. The devices are presented using their shortcut, following the logic that 2M6 stands for the AP2-M-006 device.

Table 3. Summary of AP-NURSE devices installed in the red zone

Room ID	Locaiton in the room	Gender / age	Characteristics of the monitored patient	Primary AP - NURSE unit	Secondary AP - NURSE unit
I/025	Under the bed (wall)	M/66	Dementia, brain tumor - walking	AP1-H-005 (1H5)	-
	In front of the balcony door	-	-	-	-
I/026	Under the bed (window)	F/82	Alzheimer's disease - wheelchair	-	-
	Under the bed (wall)	F/81	Alzheimer's disease - walking	AP1-H-001(1H1)	-
	In front of the balcony door	-	-	-	AP2-M-004 (2M4)
I/030	Under the bed (window)	F/84	Alzheimer's disease - walking	AP1-H-002 (1H2)	-
	Under the bed (wall)	F/90	Alzheimer's disease - walking	-	-
	In front of the balcony door	-	-	-	AP2-M-002 (2M2) (NO DATA)
I/033	Under the bed (wall)	M/73	Schyzofrenia, dementia - walking	AP1-H-006 (1H6)	-
	In front of the balcony door	-	-	-	AP2-M-006 (2M6) (NO DATA)
I/038	Under the bed (window)	M/76	Alzheimer's disease - walking	-	-
	Under the bed (wall)	M/89	Alzheimer's disease - walking	AP1-H-008 (1H8)	-
	In front of the balcony door	-	-	-	AP2-M-008 (2M8)
I/039	Under the bed (wall)	M/87	Alzheimer's disease - walking	AP1-H-009 (1H9)	-
	In front of the balcony door	-	-	-	AP2-M-007 (2M7)
I/043	Under the bed (wall)	F/82	Alzheimer's disease - walking with help	AP1-H-003 (1H3)	-



	In front of the balcony door	-	-	-	<i>AP2-M-003 (2M3)</i>
RCM	Above the door from the red to the main corridor	N/A	Multiple patients and caregivers	<i>AP4-H-002 (4H2)</i>	-
RCS	Above the door from the red to the side corridor	N/A	Multiple patients and caregivers	<i>AP4-H-006 (4H6)</i>	-

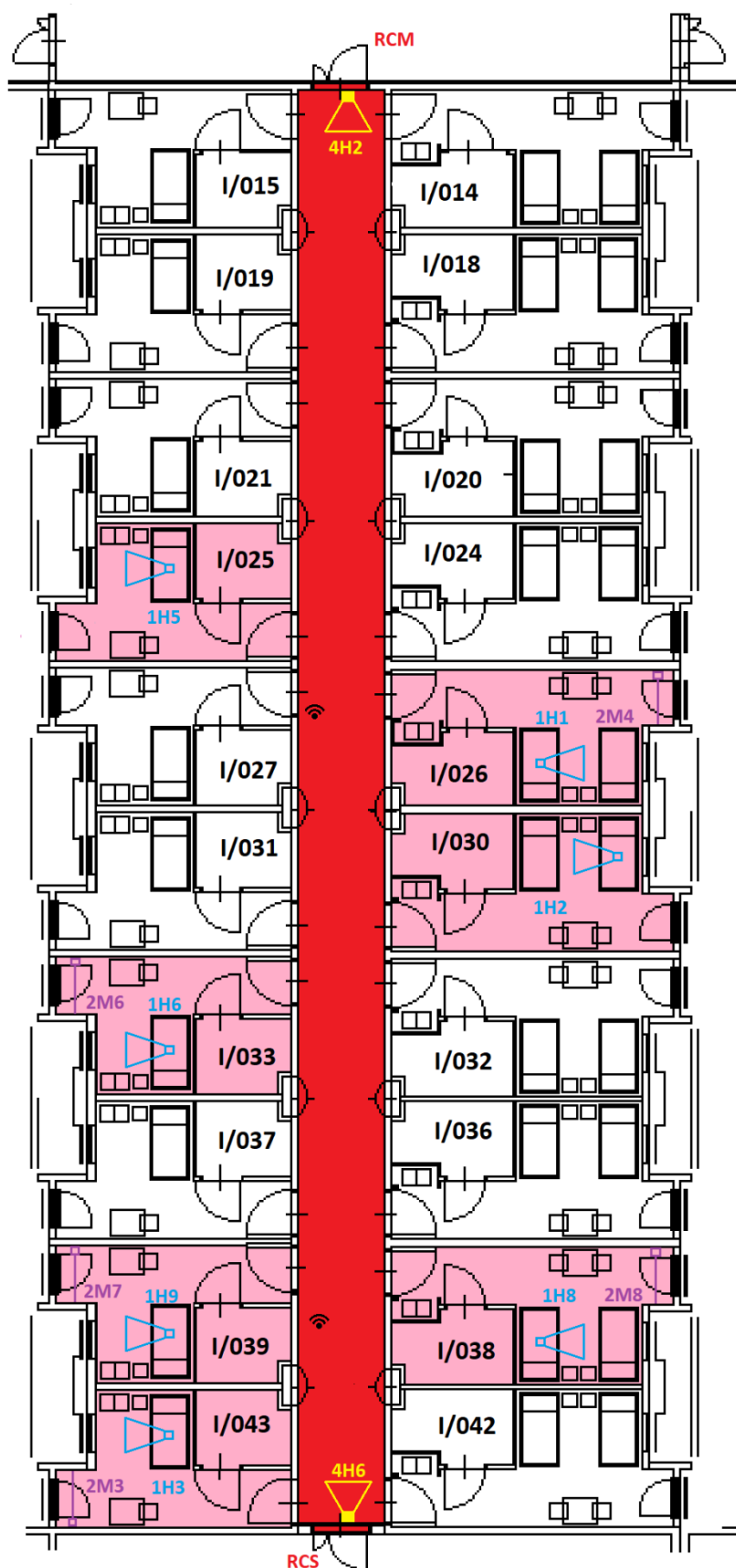


Figure 14. Map od of AP-NURSE devices installed in the red zone

3.4. Kitchens

In addition to patients rooms, the AP-NURSE devices were installed in three kitchens, when during daytime, meals are served to the mobile patients. There is one kitchen in each zone (red, green, orange) and the entrances to these kitchens are from the side corridor. Usually, during the night mode, the kitchens are locked by the personnel. The purpose of installing AP-NURSE devices into kitchens is to detect possibility of fire event, gas leakage, and unauthorized access, therefore the AP6-W devices were installed. Each device is installed on the fridge and can monitor multiple patients and caregivers. The summary of the installed devices can be found in **Table 4**. The locations and the footage of AP6-W devices in the kitchens are shown in **Figure 15 - Figure 17**.

Table 4. Assignment of devices to kitchens in the orange, green and red zone

Room ID	Locaiton in the room	Characteristics of the monitored persons	Covered area	AP -NURSE unit
OK	Placed on the fridge in the orange kitchen	Multiple patients and caregivers	From the door to the fridhe	AP6-W-008 (6W8)
GK	Placed on the fridge in the orange kitchen	Multiple patients and caregivers	From the door to the fridhe	AP6-W-009 (6W9)
RK	Placed on the fridge in the orange kitchen	Multiple patients and caregivers	From the door to the fridhe	AP6-W-010 (6W10)

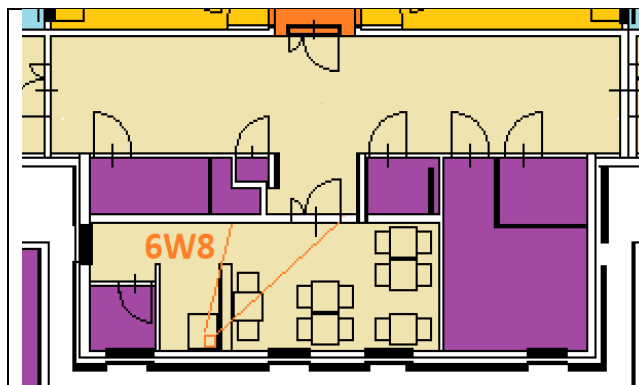


Figure 15. Deployment of the AP-NURSE AP6-W-008 (6W8) device in the orange kitchen

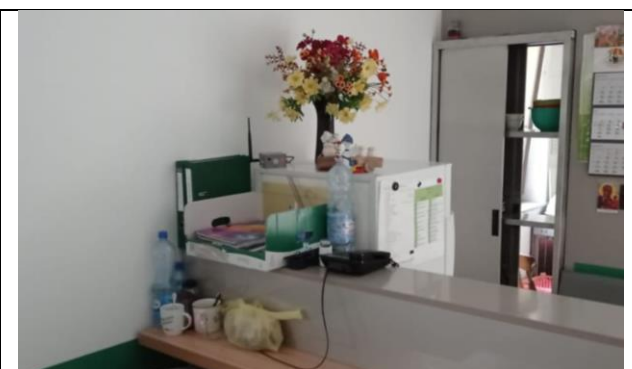
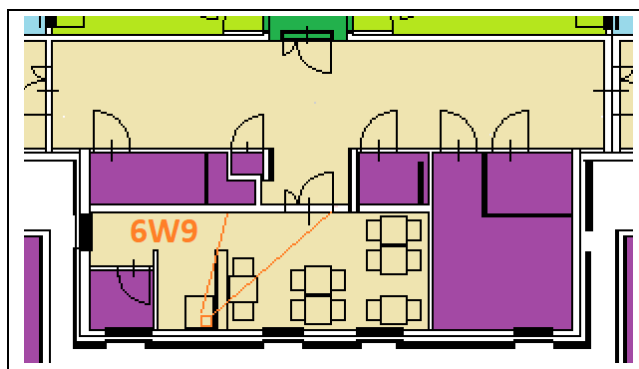


Figure 16. Deployment of the AP-NURSE AP6-W-009 (6W9) device in the green kitchen

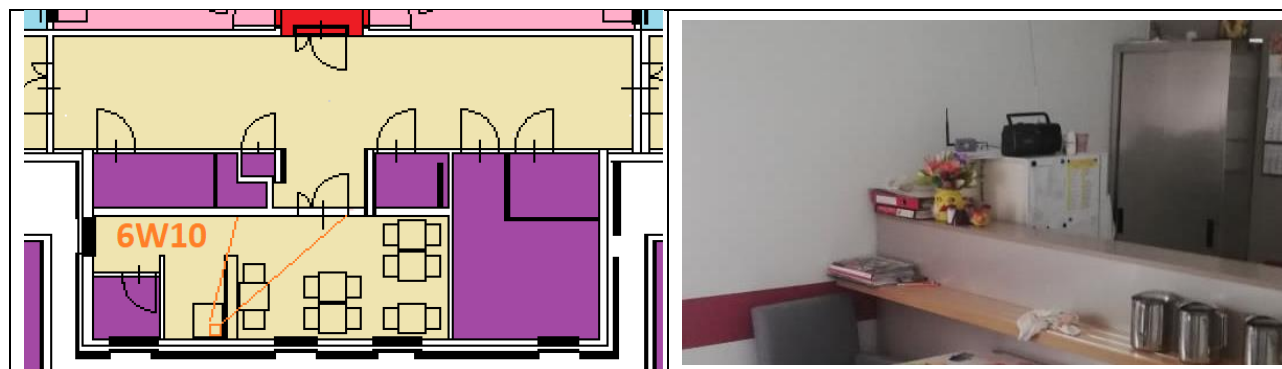


Figure 17. Deployment of the AP-NURSE AP6-W-009 (6W9) device in the red kitchen

3.5. Exits

The last set of monitoring devices was installed near the exits from the controlled area. Even though the doors are locked by a physical or magnetic lock, attempts of patients to escape from the controlled area should be signaled to caregivers. Therefore 4 AP4 devices were installed, two on the exits from the main corridor and two on the exits from the side corridor. Two out of the four devices are installed above the exit doors from the orange zone and are supplied from the emergency light panels, one is placed under a small table near the orange exit from the main corridor and one is installed on the door to the service area, located on the right side of the side corridor towards the red exit. The last two devices are directly supplied from the wall outlet on the corridors. There are two AP4-H, one AP4-W and one AP4-M devices installed. The summary of the installed devices can be found in **Table 5**. The locations and the footage of AP4 devices installed to monitor the exits are shown in **Figure 18 - Figure 25**.

Table 5. Assignment of devices to exits from the main and side corridor

Room ID	Locaiton in the room	Characteristics of the monitored persons	Initiation event	AP -NURSE unit
OME	Above the door of the orange exit from the main corridor	Multiple patients and caregivers	Approaching the first door	AP4-H-003 (4H3)
OSE	Above the door of the orange exit from the side corridor	Multiple patients and caregivers	Approaching the frist door	AP4-H-001 (4H1)
RME	Above the door of the red exit from the main corridor	Multiple patients and caregivers	Approaching the door	AP4-W-007 (4W7)
RSE	Above the door of the red exit from the side corridor	Multiple patients and caregivers	Approaching the door	AP4-M-003 (4M3)

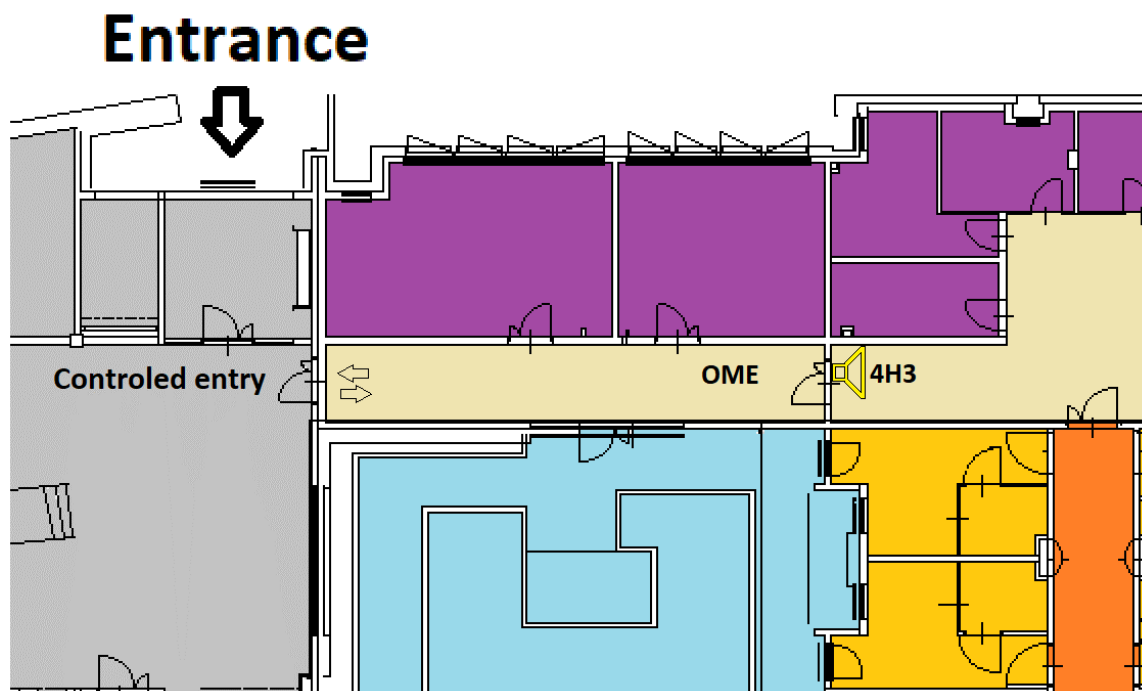


Figure 18. Map showing the position of the AP4-H-003 (4H3) device



Figure 19. AP4-H-003 device installed above the door of the orange exit from the main corridor

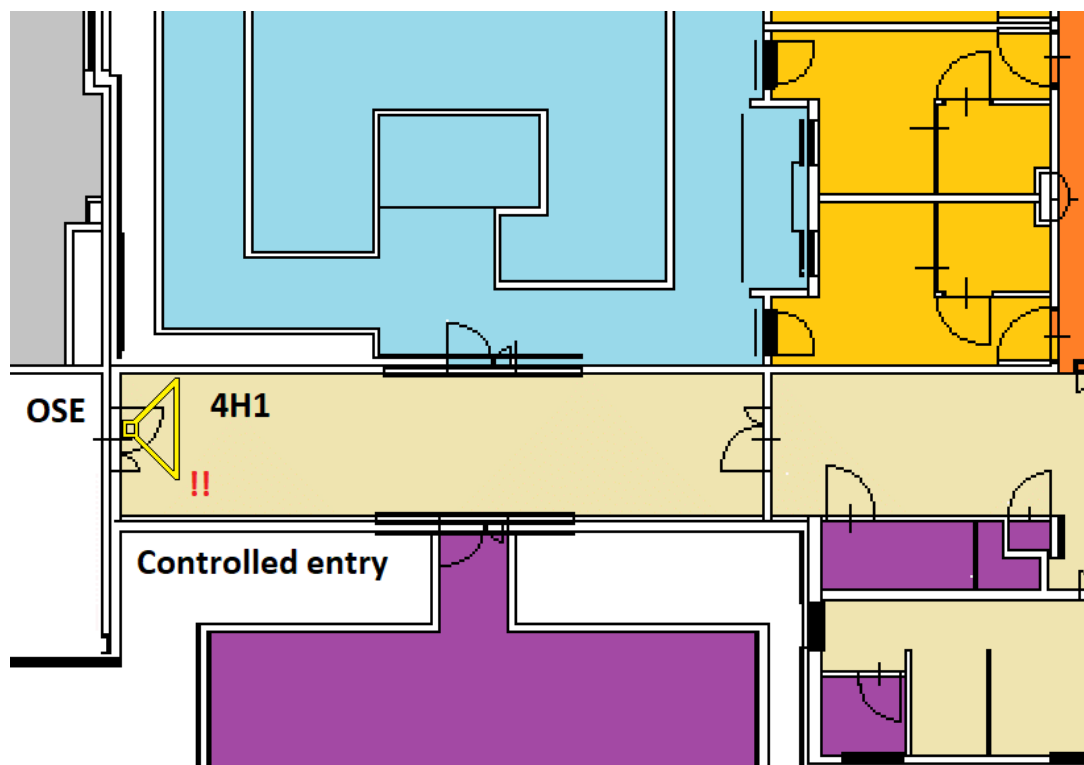


Figure 20. Map showing the position of the AP4-H-001 device

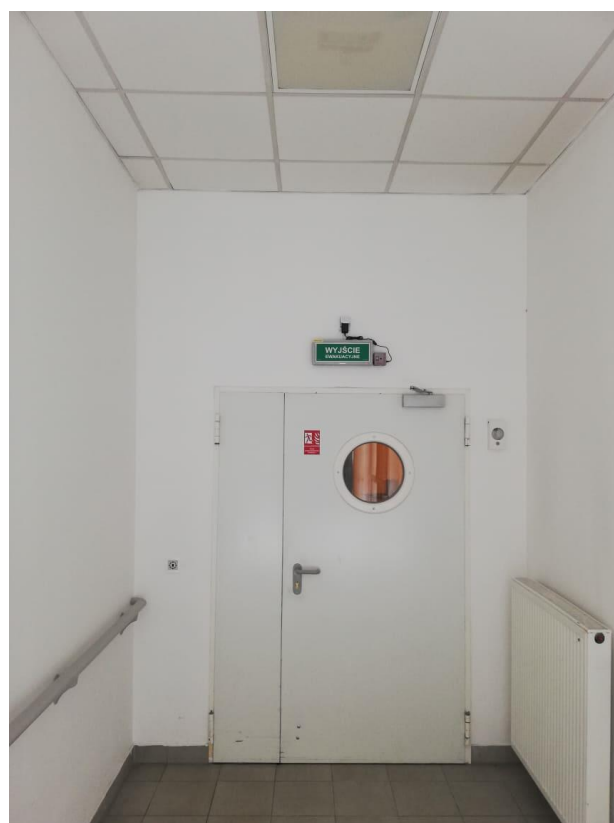
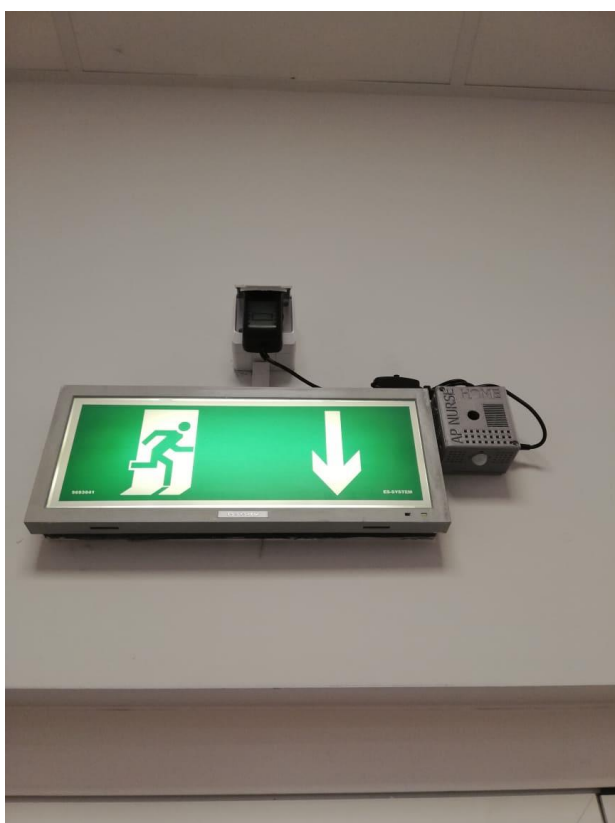


Figure 21. AP4-H-001 device installed above the door of the orange exit from the side corridor

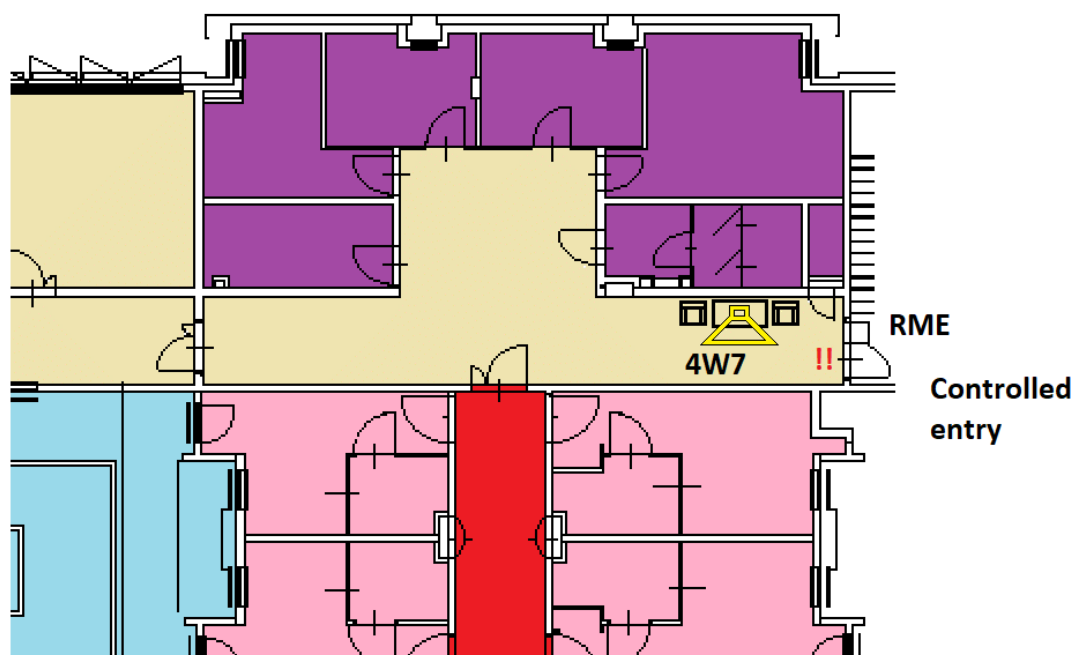


Figure 22. Map showing the position of the AP4-W-007 (4W7) device



Figure 23. AP4-W-007 device installed above the door of the red exit from the main corridor

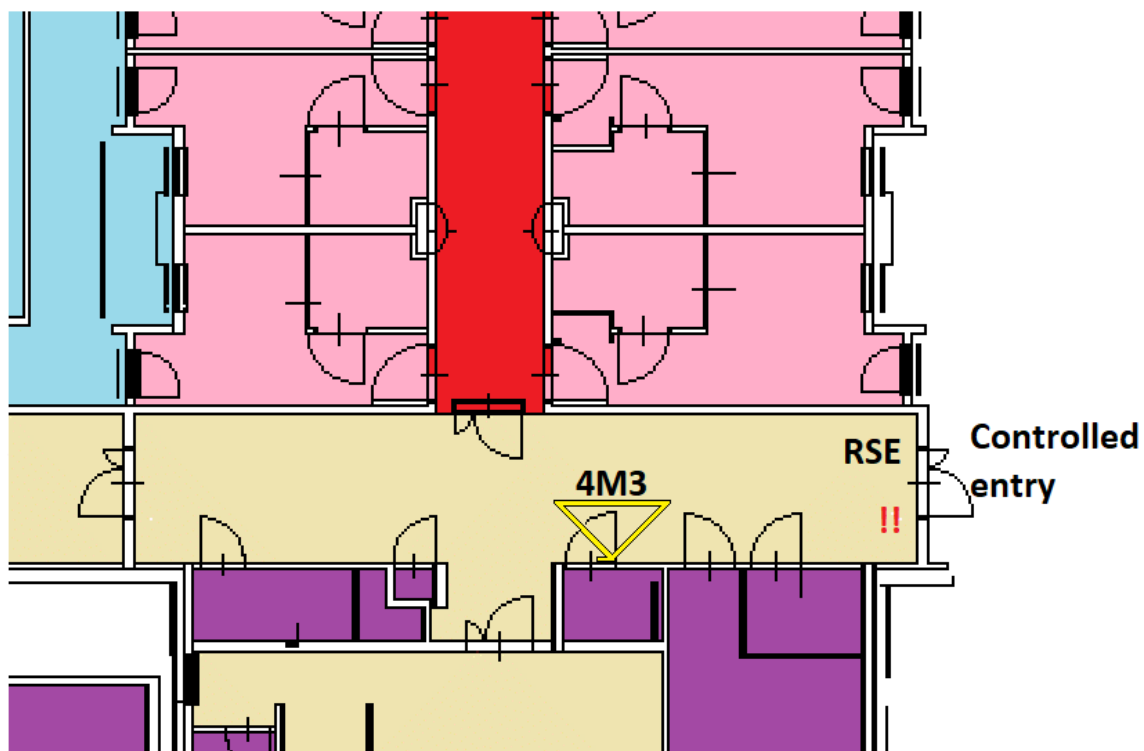


Figure 24. Map showing the position of the AP4-M-003 device



Figure 25. AP4-M-003 device installed above the door of the red exit from the side corridor

4. Instalation and testing procedure

The installation and testing of the AP-NURSE devices was performed based on a specific procedure, consisting of the following steps:

1. Selection of the room for installation
2. Selection of the devices for the given room
3. Installation of devices
4. Testing of the functionality of the installed devices
5. Replecament or restart of malfunctioning device if necessary

4.1. Selection of rooms

Rooms for the installation of devices were picked by the personell of the Social Home. In the selection, the emphasis was on the behavior and helth conditions of the patients. They selected rooms are presented in the figures in the previous section. Another important parameter influencing the selection of rooms is the strenghr of the WiFi signal. The WiFi signal strength must be appropriate for the devices to achieve stable connection to the information system, which is used for data collection. If the WiFi coverage was insufficient, additional access points were installed or the rooms selected by the personell of the Social Home were replaced.

4.2. Selection of devices

The selection procedure was influenced by the following facts:

1. Monitoring patterns related to the patients (movement, light etc.)
2. Possible location of the device in the room
3. Strength of the WiFi signal in the room

When the monitoring needs of the patient(s) are established, the initial - optimal - pick of the device(s) was made. This choice was changed when there was no suitable location for installation in the room and also if some parts of the room were not very well covered by WiFi signal.

4.3. Instalation

Based on the above mentioned procedure the selected final device(s) was/were installed in the rooms and common areas. In the patients rooms one or two devices were installed, the main devices under the patients bed (AP1) and an auxiliary device (AP2) on the door to the balcony. The devices were physically attached to the bed structure using tapes, the pressure sensors were placed under the mattress and the PIR sensor was oriented to cover the bedside area. The AP2 devices were either attached to the balcony door or to the wall next to the door, using two-sided tapes to not make construction intervention. The installation of the AP1 devices is illustrated in **Figure 26**.



Figure 26. Instalation of AP1 devices under the patient's bed

In the common areas two types of devices were installed, AP4 to monitor the corriods and AP6 to monitor the kithchens. In the corridors the devices were installed above the doors to be not reachable by the patients and effectively cover the area in a front of the doors. This operation was performed by the electricians of the Social Home. In the kitchens, the devices were placed on the top of the refrigerator, to cover the whole dining area. The electricity supply of this device was ensured from the wall outlet.

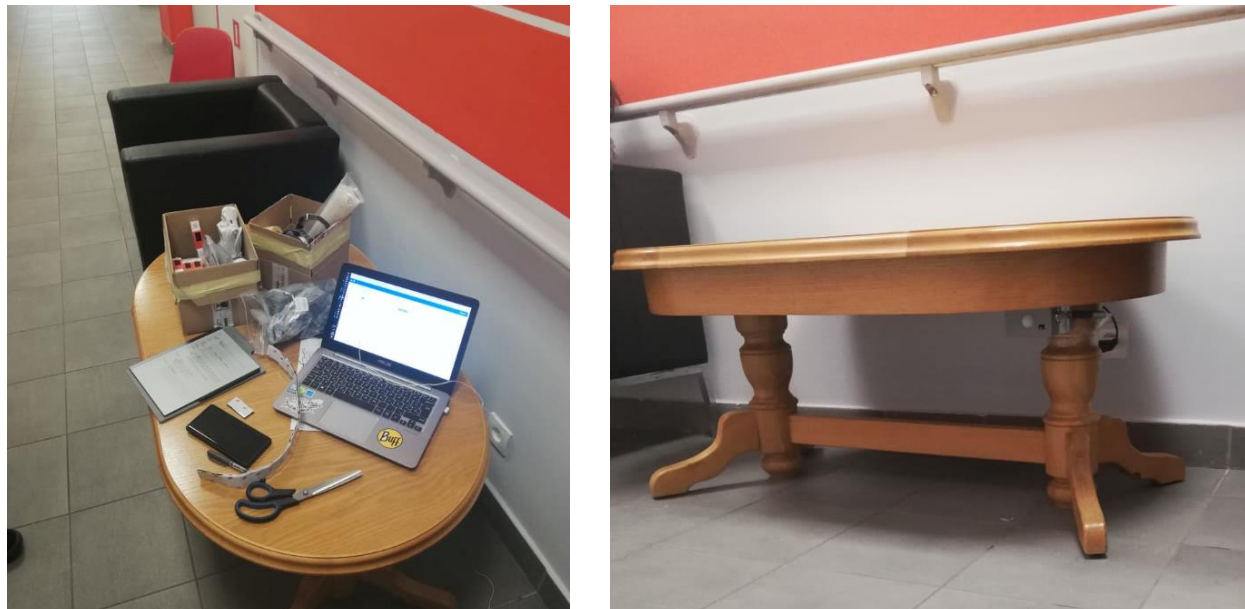


Figure 27. Instalation of AP4 device in the common area

4.4. Testing of the functionality

After all devices were physically installed, they were registered in the Information System. All the device were programmed to automatically connect to the information system. If the connection was not successful, manual connection was carried out. Basic sensor functionality (without notifications and alerts) was tested on-site right after the installation. Every sensor in the room was tested prior to standard operation. If all sensor tests were passed, the devices was ready to use.

4.5. Replacing malfunctioning devices

If the outputs from the sensors in the information system were not corresponding to the test inputs (movement, sitting on the bed, etc.), the following corrective measures took place:

- Changing the position of the device in the room (if possible)
- Replacing the device to a new unit
- Changing type of the device
- Removing the device from the room

In some cases, due to various reasons, all sensor tests could not be reached. It means that the system was unable to monitor some changes of the environment, which, in the worst-case scenario, led to removing the device from the room. In the majority of the cases changing the position or type of the device was sufficient to improve the test results.

5. Data management of the AP-NURSE devices

The monitoring system is working through the internal network of the care center. The simplified scheme of the data management is shown in **Figure 28**. The monitoring devices of the AP-NURSE technology are connected to the internal network through the specific Wi-Fi SSID. The Wi-Fi routers are connected to the ethernet network and all measured data with the certified signature of the devices are sent to the bridge server. The security of the measured data is ensured by the ciphered communication with the servers of the information system. The bridge server handles all the communication within the measuring devices and transfers the data to the main servers of the information system with the necessary certification of the communication. There are two separate main servers installed. One server (referred to as the offline server) is located directly at the care center. The offline server is a standalone system and the information system can be accessed directly only through the internal network of the Social Care Home. To enhance the safety and security of the system, as well as to have the measured data available for analysis at STU, the measured data are crypted and then also sent to the online server, which is located in Bratislava. Thanks to the redundancy of the system, safety is ensured during the update, maintenance, or possible failure of the offline server.

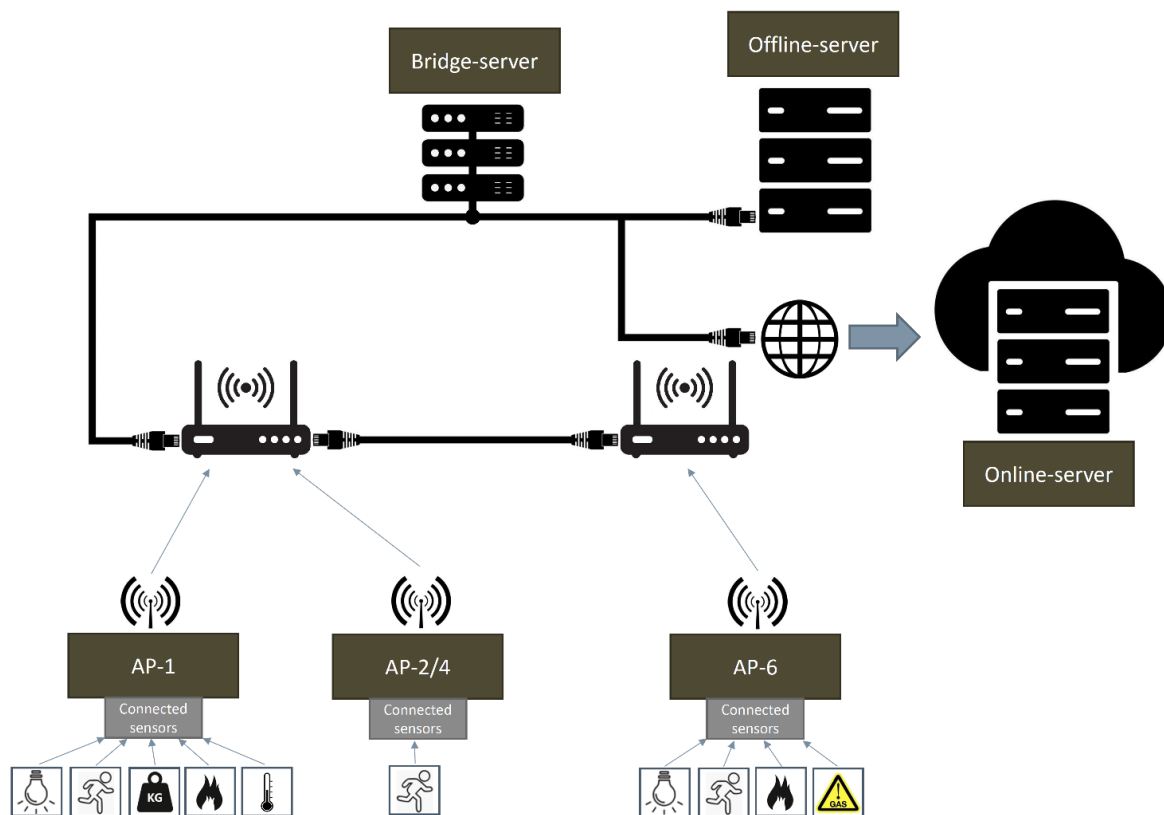


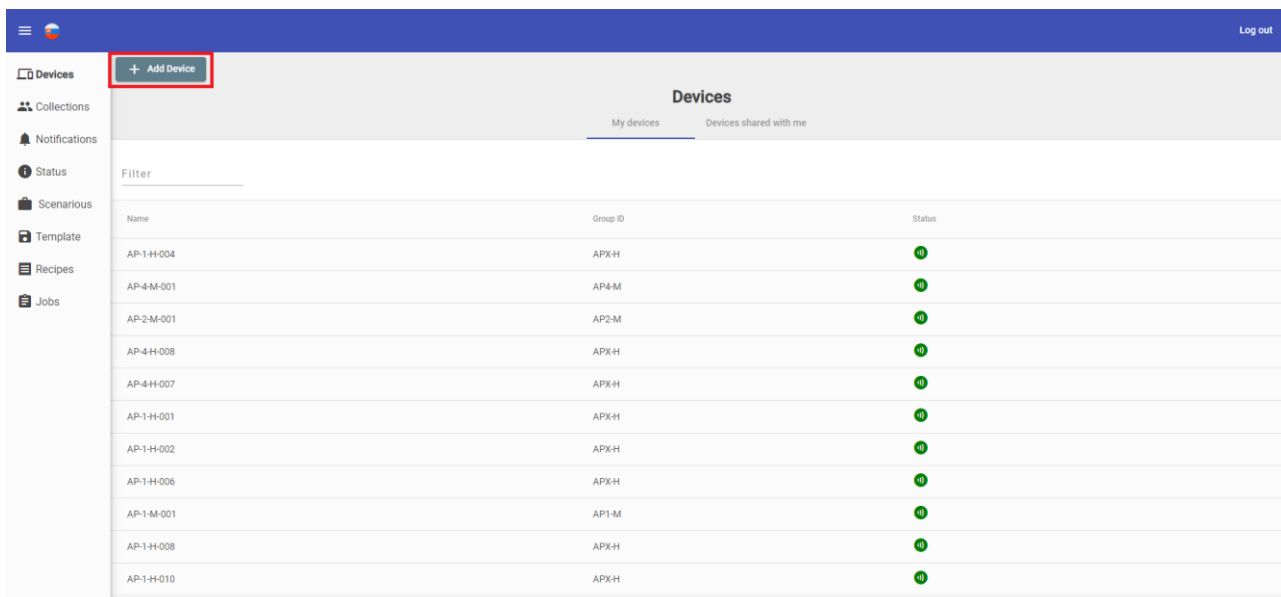
Figure 28. Schematics of the data management



Figure 29. Photo of the server room

5.1. Registration and connection of devices to the information system

After the physical installation of the AP-NURSE devices in dedicated rooms and corridors of SCH, the devices are connected to the internal network through WiFi connection. If the SSID (Service Set Identifier) and the password are not set, the AP-NURSE devices create a local WiFi hotspot, where it is possible to connect and set up the correct SSID and password of the internal network for further communication. The setup of the network in the device can be accessed through the web browser through the following IP address: 192.168.4.1. After successful connection of the device to the internal network, it is necessary to add the device to the information system. The IP address of the information system is: 192.168.2.6. The offline information system can be accessed only through the internal network of the Social Care Home. After login to the information system, the device can be registered in the *Device tab (Urządzenia)* through the + *Add device (Dodaj urządzenie)* button **Figure 32**.

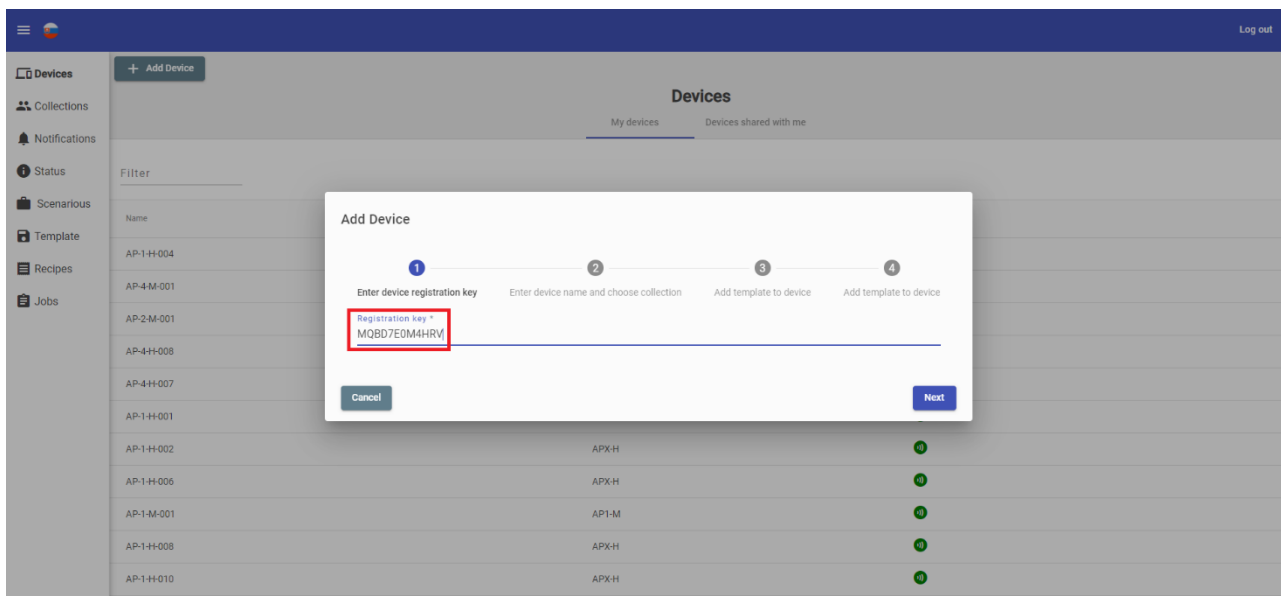


The screenshot shows the 'Add Device' button highlighted with a red rectangle in the top left navigation bar. The main area displays a table of existing devices.

Name	Group ID	Status
AP-1-H-004	APX-H	ON
AP-4-M-001	AP4-M	ON
AP-2-M-001	AP2-M	ON
AP-4-H-008	APX-H	ON
AP-4-H-007	APX-H	ON
AP-1-H-001	APX-H	ON
AP-1-H-002	APX-H	ON
AP-1-H-006	APX-H	ON
AP-1-M-001	AP1-M	ON
AP-1-H-008	APX-H	ON
AP-1-H-010	APX-H	ON

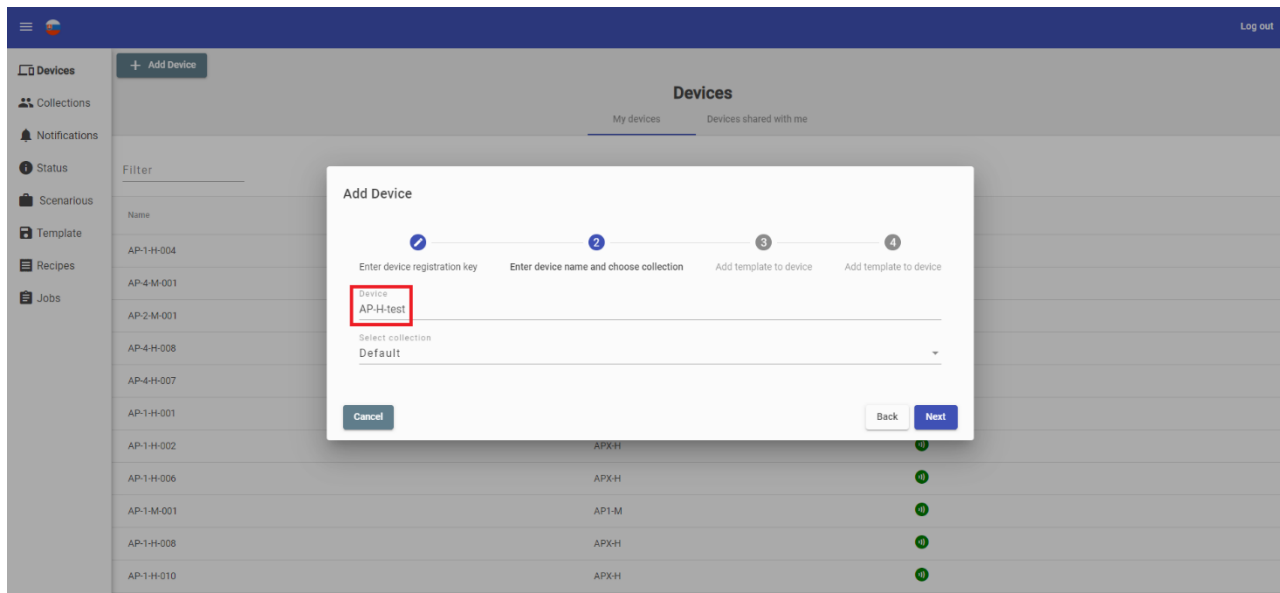
Figure 30. Add device function in the information system

Based on the unique *Registration key* (*Klucz rejestracyjny*), the device can be added to the information system (Figure 31). This unique key is generated when the administrator of the information system is registering the device into the back-end of the server. After clicking next, the *Device* (*Urządzenie*) name can be entered in the information system together with the *collection* (*kolekcja*), as shown in Figure 32. The collection field may be left in the *Default* option and this option can be changed later in the information system if necessary. The next option is the selection of the *Template* (*Szablon*) for the device if the template was previously defined in the information system. Based on the type of the device, a proper template can be selected (Figure 33). This option can be also left in the *Default* setup and can be manually changed later. The last stage of the device registration is the summary tab, where it is possible to check all the input parameters of the device and the whole process is finished after clicking the *Confirmation* (*Potwierdzenie*) button (Figure 34).



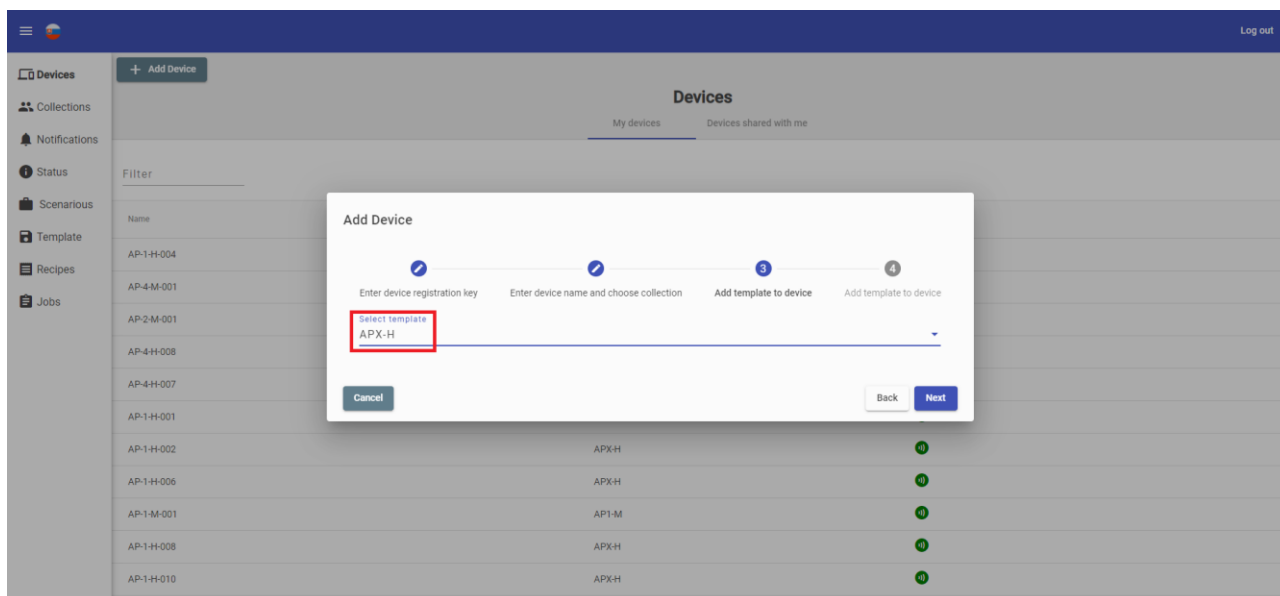
The screenshot shows the 'Add Device' dialog box with a red rectangle highlighting the 'Registration key' input field. The dialog box has four steps: 1. Enter device registration key, 2. Enter device name and choose collection, 3. Add template to device, and 4. Add template to device. The 'Registration key' field contains the text 'MQBD7E0M4HRV'.

Figure 31. Entering of the device registration key in the information system



The 'Add Device' modal is displayed over a background of a device list. The modal has a progress bar with four steps: 1. Enter device registration key, 2. Enter device name and choose collection, 3. Add template to device, and 4. Add template to device. Step 2 is the current step. The 'Device' dropdown is set to 'AP-H-test'. The 'Select collection' dropdown is set to 'Default'. The modal has 'Cancel', 'Back', and 'Next' buttons.

Figure 32. Selection of the device name and template in the information system



The 'Add Device' modal is displayed over a background of a device list. The modal has a progress bar with four steps: 1. Enter device registration key, 2. Enter device name and choose collection, 3. Add template to device, and 4. Add template to device. Step 3 is the current step. The 'Select template' dropdown is set to 'APX-H'. The modal has 'Cancel', 'Back', and 'Next' buttons.

Figure 33. Template selection for newly registered device in the information system

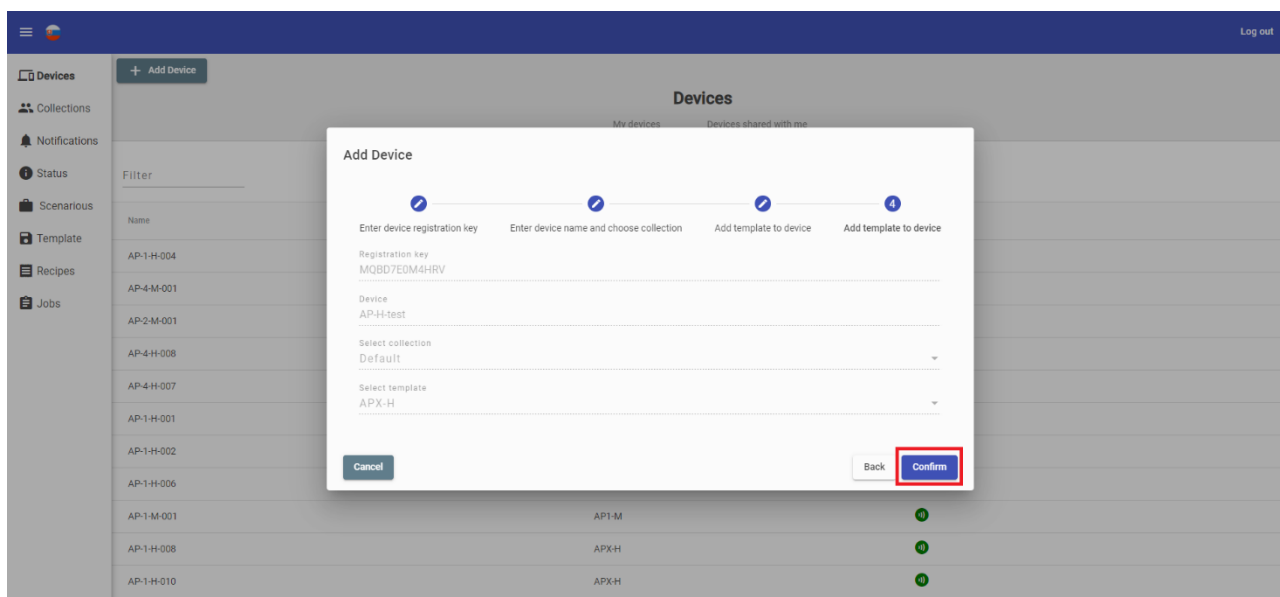


Figure 34. Device registration summary and confirmation in the information system

6. Conclusion

This deliverable summarizes the findings from the installation of AP-NURSE devices in the Social Care Home Warsaw, as part of the Output O.T3.3 - Pilot testing of AP-NURSE - persons suffering from Alzheimer's disease in Social Care Home in Warsaw. It covers the selection of devices for testing, deployment of devices, installation and testing procedure as well as the data management of devices. The devices were installed in the patients' rooms in the orange, green and red zone of the controlled area, on the corridors, exits from the controlled area and also in the kitchens of the SCH Warsaw. In total, 48 devices were installed, among which 17 are AP-NURSE Home, 22 are AP-NURSE Care M5stack and 9 are AP-NURSE Care Waspnote. **Table 6** summarises the installed devices. This table also serves to update the status of devices during the testing. All installed devices were connected to the local WiFi network, which serves to deliver the data to the bridge server which subsequently provides the data for the main servers of the information system. There are 2 main servers, one offline, located in Warsaw that is directly accessible only through the local network of the centre, and one online, located in Bratislava, serving for further data analysis. The notifications from the connected devices are shown in the information system, which is accessible for the caregivers through their PC, tablet or mobile device. For each device a specific monitoring scenario was set up. In these scenarios the time period during the night shift (9:PM and 5 AM) is monitored. There are two types of events:

- Abnormal condition (orange alert)
 - If the PIR sensor detects movement in the patients' room
 - If the ToF or hall effect sensors detect opening the balcony door
- Critical condition (red alert)
 - If the PIR sensor detects movement in the corridor
 - If the PIR sensor detects movement in the kitchen

An example of the monitoring scenarios is shown in **Figure 35**. Since the information system requires user authentication, 3 user (pomaraneczowy@ca.waw.pl, zielony@ca.waw.pl, czerwony@ca.waw.pl) and one administrator accounts (asi@ca.waw.pl) were created for the caregivers of the Social Care Home. The user accounts have limited functions, while the administrator account allows operative changes in the system.







G/026					
Stan aktywny	Tytuł	Aktywne dni	Opis	Surowość	Zaktualizuj scenariusz
	MOTION-MEDIUM-PL-BED	P U S S P S N 00:01 - 00:00	MOTION-MEDIUM-PL	Sredni	
	MOTION-MEDIUM-PL-HALL	P U S S P S N 00:01 - 00:00	MOTION-MEDIUM-PL	Sredni	
Abnormal event					
Wejscie Głowne od al. Willanowskiej					
Stan aktywny	Tytuł	Aktywne dni	Opis	Surowość	Zaktualizuj scenariusz
	MOTION-HIGH-PL	P U S S P S N 00:01 - 23:59	MOTION-HIGH-PL	Wysoki	
Critical event					

Figure 35. Examples of monitoring scenarios

Table 6. Summary of installed devices

Device ID	Status 17/05/2021	Status 30/05/2021	Status 15/06/2021	Status 30/06/2021
AP1-H-001	OK	OK	OK	To be completed
AP1-H-002	OK	No Data	OK	
AP1-H-003	OK	OK	OK	
AP1-H-004	OK	No Data	OK	
AP1-H-005	OK	OK	OK	
AP1-H-006	OK	OK	OK	
AP1-H-007	OK	No Data	No Data	
AP1-H-008	OK	OK	OK	
AP1-H-009	OK	OK	OK	
AP1-M-002	OK	No Data	OK	
AP1-M-003	OK	OK	OK	
AP1-M-004	OK	No Data	No Data	
AP1-M-006	OK	No Data	No Data	
AP1-M-007	OK	No Data	No Data	
AP1-M-008	OK	No Data	No Data	
AP1-M-009	OK	No Data	No Data	
AP1-M-010	OK	No Data	No Data	



AP1-W-002	OK	No Data	OK	
AP1-W-003	OK	OK	OK	
AP1-W-004	OK	OK	OK	
AP1-W-005	OK	OK	OK	
AP1-W-006	OK	No Data	OK	
AP2-M-002	OK	No Data	No Data	
AP2-M-003	OK	OK	OK	
AP2-M-004	OK	OK	OK	
AP2-M-006	OK	No Data	No Data	
AP2-M-007	OK	No Data	No Data	
AP2-M-008	OK	OK	OK	
AP2-M-012	OK	OK	OK	
AP2-M-013	OK	OK	OK	
AP2-M-014	OK	OK	OK	
AP2-M-016	OK	OK	OK	
AP2-M-018	OK	OK	OK	
AP2-M-019	OK	OK	OK	
AP2-M-020	OK	OK	No Data	
AP4-H-001	OK	OK	OK	
AP4-H-002	OK	OK	OK	
AP4-H-003	OK	OK	OK	
AP4-H-004	OK	OK	No Data	
AP4-H-005	OK	OK	OK	
AP4-H-006	OK	OK	OK	
AP4-H-008	OK	OK	OK	
AP4-H-009	OK	OK	OK	



AP4-M-003	OK	No Data	No Data	
AP4-W-007	OK	No Data	No Data	
AP6-W-008	OK	OK	OK	
AP6-W-009	OK	OK	OK	
AP6-W-010	OK	OK	OK	
Operation rate	100%	65%	71%	