Manual of the SE10 Room Terminal

Software Versions:

Config: 2.1.0

Live: 3.3.0

Activity: 2.2.0

Manager:1.1.0

Systems: 2.2.4

Pushover: 0.0.3-beta.3

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1 Introduction

This document describes the functions of the room terminal SE10 as they are accessible after the SensFloor® underlay and the SE10 have been installed. For the installation of the underlay and the electrical installation of the SE10 including a wiring diagram, refer to the manual “E_SensFloor_Installation”. For the integration of multiple SE10 room terminals into a complete SensFloor® Care System refer to the manual “E_Manual_Ward_Terminal”.

In the first part of this document, the mapping and testing of the SensFloor underlay is described. In the second part, the configuration of SensFloor functions is shown. Note that most of the functions refer to the SensFloor Care system but can be used in other domains as well. The mapping and testing of the underlay and the configuration of the SE10’s potential-free relays work for any SensFloor installation.

The document on hand is meant as a general overview. For more details concerning the technical specifications and the configuration and operation of the various functions, refer to additional documents listed in the “References” section.

Please note that at some places in this manual and in the graphical user interface (GUI) it describes, numbers appear in hexadecimal notation (hex) that uses the symbols A to F for the decimal numbers 10 to 15.

For easier reference, expressions that appear on the system’s GUIs are printed in ***Capital bold face italics***.

2 What is new?

If you have an earlier version of this document, you might be interested in what has changed in the software and consequently in the description within this manual.

Changes in Activity 2.2.0:

- Number of external sensors increased to three
- Added support for different backend-frontend time zones
- Added support for routes and query parameters

Changes in Config 2.1.0:

- Warning when creating/editing overlapping patches
- External sensors increased to three
- Added support for different backend-frontend time zones
- Floor sensitivity can now be adjusted per module

Changes in Systems 2.2.4:

- Removed the “Start” column as this functionality is handled by the Manager app
- Added URL based safety layer for expert mode
- Added 5-minute timer to disable expert mode
- CPU temp is shown in Celsius and Fahrenheit
- Added reboot and shutdown buttons for expert mode
- Fixed display of “Remote Access”
- Changed selection of WiFi mode
- Fixed time zone name detection

Changes in Manager 1.1.0:

- Support for Pushover and Systems App

3 The SE10

3.1 Connections of the SE10

The SE10 is delivered in two versions: SE10H and SE10F. Depending on the application, either a flat compartment (SE10F) or a DIN-rail (top-hat-rail) compartment (SE10H) may be appropriate. The connections and functions of the two versions are identical but only in the SE10H the potential-free relays can be accessed through screw terminals. While the SE10F is powered by a micro-USB wall plug-in AC/DC adapter (middle image), the SE10H requires a DIN-rail power supply (left image).

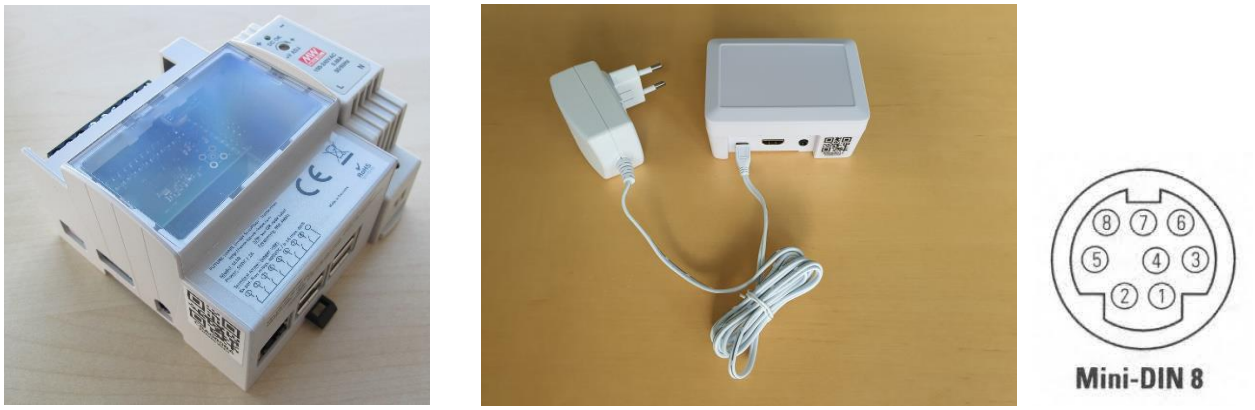


Fig. 1: SE10 room terminal in DIN-rail (SE10H, left) or flat compartment (SE10F, middle).Optional connector for external sensors (right)

The SE10 is equipped with an RJ45 socket for LAN connection, an HDMI port for a monitor and multiple USB ports for the connection of mouse keyboard or touch panels. Sound is transmitted to the loudspeakers of a monitor that is connected via HDMI.

The SE10 contains an expansion board to receive wireless sensor signals from the SensFloor underlay (radio range up to 20m indoor). The expansion board is equipped with eight potential free relays (solid-state photo MOSFET type ASSR 4118, 60VDC, 100mA max.) which share a common pole. These nine connections are accessible in the SE10H-version via screw terminals. The wiring diagram of the terminal is printed on the label. The relays can be configured to react to events on the SensFloor (see below). In addition, the expansion board is equipped with a real time clock (RTC) module DS3231.

Optionally, the SE10H can be equipped with a Mini-DIN socket (Fig. 1, right) that allows for the connection of up to three external switches/relays (see section 4.1.5, “external sensors”). In that case, the socket’s shielding is the common pole. Connecting the pins 1,2 or 3 with this common pole by means of a potential-free (dry) contact of an external sensor, will trigger the events ***External Sensor 1***, ***External Sensor 2*** or ***External Sensor 3*** as described in section 4.1.5. In a standard mini-DIN cable, the pins correspond to the colors 1=red, 2=orange and 3=green.

The SE10’s software is contained on a 32GB micro-SD memory card that can be accessed without opening the compartment. This way, updates can be applied either by swapping the SD card or by accessing the SE10 over the network.

3.2 Powering up the SE10

The SE10 is powered up by connecting power to the micro-USB socket. Only the AC/DC adapter delivered together with the SE10 (5VDC, 2.5A min.) shall be used as low current supply can lead to malfunction. When using the HDMI output, the monitor must be already connected when the SE10 is powered up. Booting up into operation mode takes around two minutes and requires no manual interaction so that even after a power blackout the system restarts automatically. With the default software, the system boots directly into a full screen view of the system’s web browser showing one of the default apps as GUI (*graphical user interface*). Usually, this is the ***Config***-page (see section 4.1), however, by means of the system configuration page ***System***, the

HDMI's default output app view can be changed (see section 4.4). If the attached monitor has touch screen functionality, the corresponding cable can be connected to one of the SE10's USB ports. In that case, the apps can be switched through touch gestures within the GUI.

3.3 Connecting to the SE10 through Wi-Fi, wired network or internet

Once the SE10 has booted up, it becomes a Wi-Fi access point the name of which (SSID) contains the alphanumeric number written on the QR-code label on the compartment. By means of the password written on the main label, a user can connect a Wi-Fi-enabled client device (PC, tablet, smartphone) to the SE10. Once this connection is established, a web-browser can be started on the client and the SE10's apps can be accessed by typing-in the corresponding address in the browser's address line. The address consists of the SE10's IP address followed by a colon and the app's port number. When connected through Wi-Fi the default IP address is http://192.168.5.5 or https://192.168.5.5 for secured apps like "Config" (see below). The port numbers of the installed apps can be found on the SE10's main label.

If the SE10 is already part of a wired network, the default IP address can be replaced by the IP address that the network's DHCP server has assigned to the SE10 while the port numbers of the apps remain unchanged. Please refer to your network administrator to find out this address. Note that the network must be configured such that the apps' ports are accessible.

All apps can also be accessed through the internet if the network administrator establishes a VPN (*virtual private network*) that grants secure and transparent access to the local LAN from remote clients.

Please note that the setup and maintenance of the wired network or the VPN is not part of Future-Shape's service and must be organised by the customer! Note further that the customer is responsible for securing the network and Future-Shape cannot be held liable for any leakage of SensFloor data escaping from the customer's network!

4 The apps

4.1 Config: Mapping, testing, and configuring the SensFloor

The ***Config*** app is used for the first-time configuration and testing of the SensFloor and its functions right after the installation of the underlay. As this is a process that is crucial for the proper function of the whole system, it should only be operated by an expert. Consequently, it is addressed through secure http-access via https://192.168.5.5:9000 and requires accepting a security advice because of missing certificates.

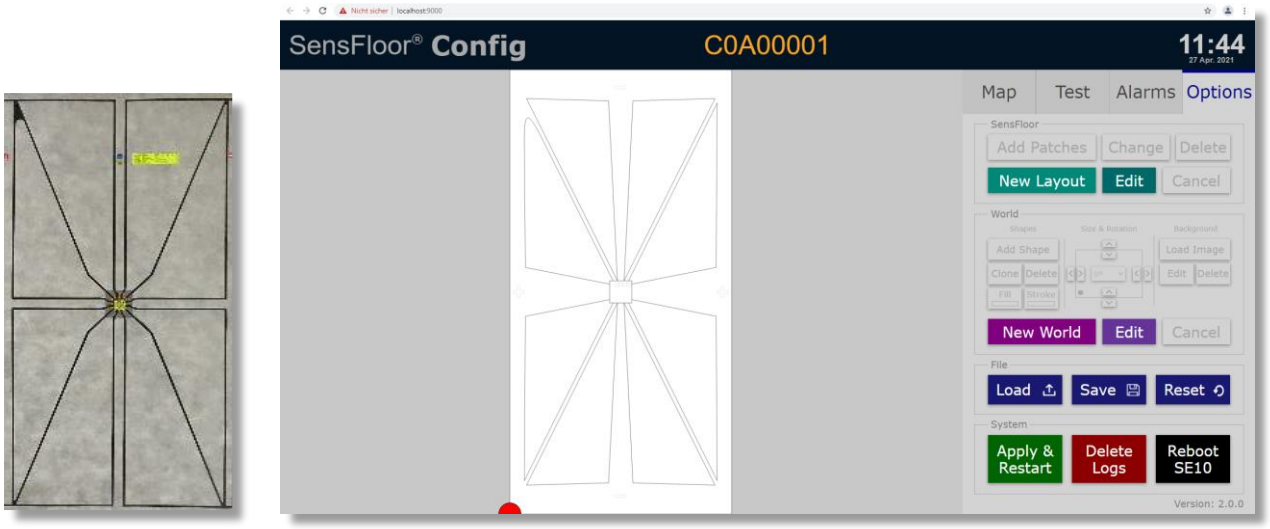


Fig 2: SensFloor patch (left) and Configuration App (right). Select the ***Options*** tab to create and configure the SensFloor layout.

When creating a layout in the GUI, it is important that it fits to the geometry of the installed SensFloor patches on the floor. Refer to “E_SensFloor_Installation_Manual” to learn about the different sorts of patches and their orientation. Although the orientation of the layout and even of single patches can be changed afterwards, the easiest way to create a layout is to choose your position and orientation in the room such that the labels on the patches are in the upper right corners and the sensor field with the rounded edge is in the upper left corner as in Fig. 2 left. In this default position, the origin of the coordinate system is in the left lower corner of the GUI as indicated by a red dot. At this stage, press ***New Layout*** to create a new/initial patch-configuration.

4.1.1 Creating the layout

In the window which appears, first select the sensors’ orientation and resolution per square meter:

- ***very high:*** square shaped, 64 sensor fields
- ***high:*** square shaped, 32 sensor fields
- ***low landscape:*** rectangular, horizontal, 16 sensor fields and
- ***low portrait***: rectangular vertical, 16 sensor fields

When choosing the number of patches in x and y, take the outer dimensions of the complete installation. It is possible to remove, rotate and shift single patches later.

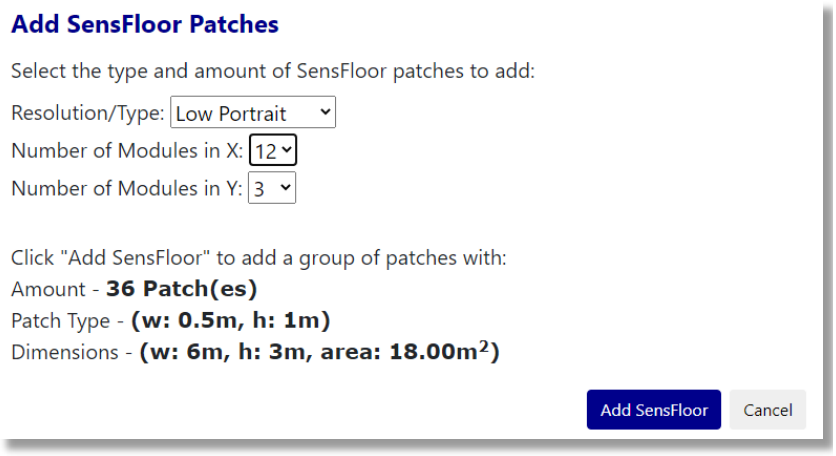


Fig. 3: Selecting the horizontal and vertical dimensions of the layout.

After tapping ***Add SensFloor***, the GUI shows the new layout with all patches highlighted/selected. At this stage it is possible to rotate the whole layout by clicking on , to select/deselect patches by clicking on them or to deselect all patches at once by clicking on X at the right corner of the information line under the layout. When patches are selected, the line shows the x/y position of the lower left corner of the frame around the selected set of patches relative to the world coordinates indicated by the red coordinate system.
The line also shows the width, height and the rotation angle of the frame surrounding the selected set of patches (see Fig. 5).
By clicking on ***Delete***, the selected patches can be removed from the layout. This is necessary when the patches do not exist in the real SensFloor installation or when they should not be evaluated by the processing algorithms anymore (e.g., because they are broken).
When deleting already mapped patches, a warning message may appear, as the mapping information of these patches will get lost.
A set of selected patches can be rotated independently of the rest of the patches.by clicking on the rotation symbols . The patches can also be grabbed and shifted to account for gaps in the real layout. When rotating patches, verify by controlling the position of the label and rounded field corner, that the resulting orientation corresponds to the real SensFloor patches on the floor!
A warning is shown when creating/editing a layout in which patches overlap.

It is also possible to change the type of patches by tapping on ***Change***. A window appears in which the resolution (low, high, very high) and orientation (portrait or landscape) can be selected.

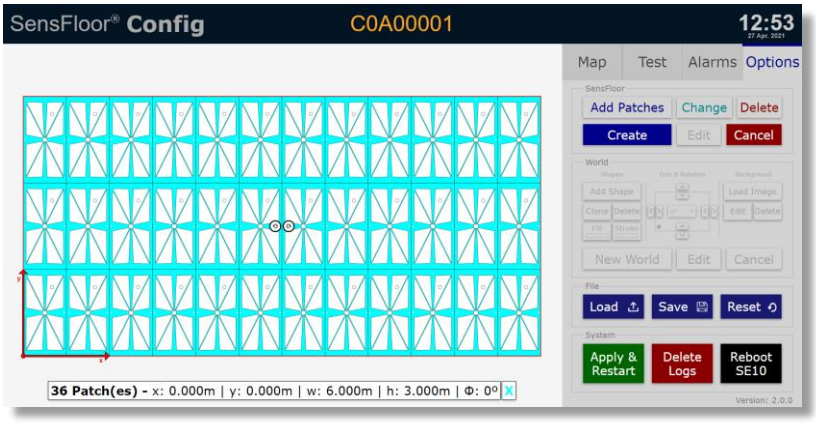


Fig. 4: Outer dimensions of the complete installation, all patches selected.

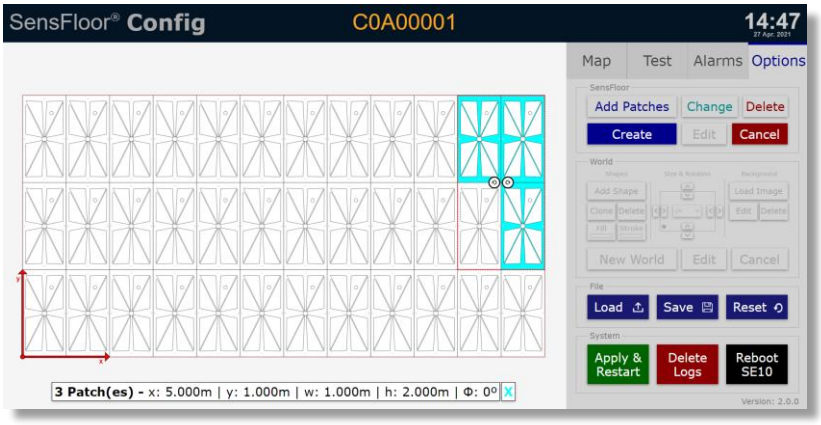


Fig. 5: Three patches selected for removal from the layout.

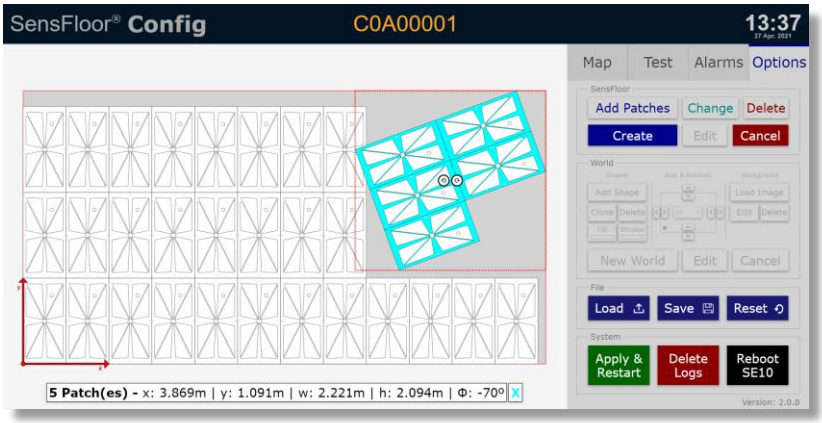


Fig. 6: Rotating and shifting a set of patches.

Fig. 7: Changing the type of patches from low to high resolution..

By tapping on ***Add Patches*** it is possible to add one or more patches to an existing layout. In the appearing window, the type and dimension of the set of patches can be chosen.
After tapping ***Add SensFloor*** the new set of patches appears at the origin of the coordinate system and can be rotated and dragged to the desired place. Please control again the correct orientation with respect to the real patch on the floor.

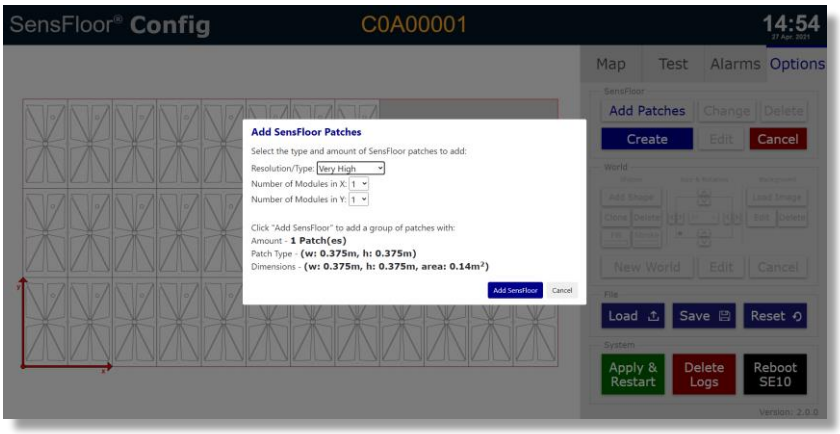


Fig. 8: Adding a new patch to an existing layout.

In the example in Fig. 9 two patches have been changed to high resolution and an additional patch with resolution “very high” was added to the layout. Note the size, position and rotation angle of the new, highlighted patch which is indicated in the line under the layout.

After tapping on X all patches are deselected, and the layout is finished by tapping on ***Create***. A warning may appear which indicates that the information of any previous layout will be overwritten. By confirming this warning, the layout is saved.

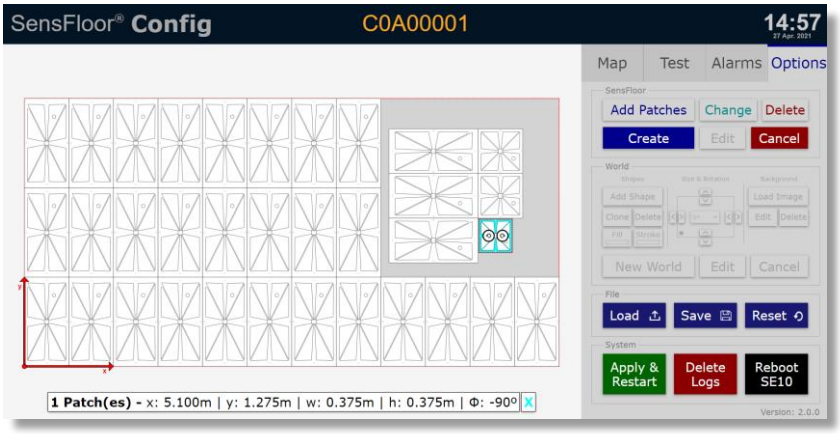


Fig. 9: Finishing and saving the layout.

A layout can be edited at any time by tapping ***Edit***. Editing an existing layout works like the creation of a new layout except that it must be saved after editing by tapping ***Save***.
At this point it is possible to enrich the layout with further graphical elements (i.e., a *World*) to make it look like the ground plan of the real room. However, in a fresh SensFloor installation it is recommended to make the IDs of the real SensFloor patches known to the room terminal before (*mapping*).

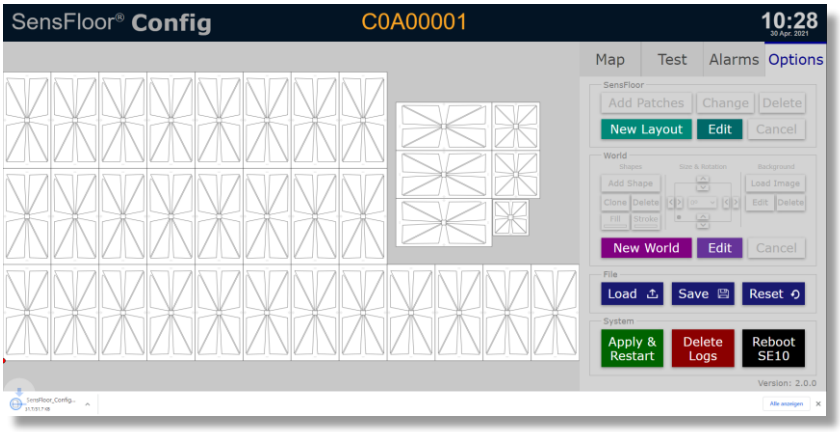


Fig. 10: Saving the current configuration to the client (see lower left corner).

For this process, the current configuration must be saved by tapping the blue ***Save*** button. A file named “SensFloor_Config_...” will be saved to the client. To start the mapping procedure, leave the ***Options*** tab and go to the ***Map*** tab.

4.1.2 Mapping

After creating the plan, the IDs of the installed sensor modules (given by their QR codes) must be made known to the SE10. This process is called *mapping*. Based on this information, the SE10 can detect where a sensor event was generated, as the IDs are part of the wireless sensor messages. As long as no ID is assigned to a patch, it remains white in the layout.
The hexadecimal IDs can be entered either by means of the keypad (see Fig. 11) …

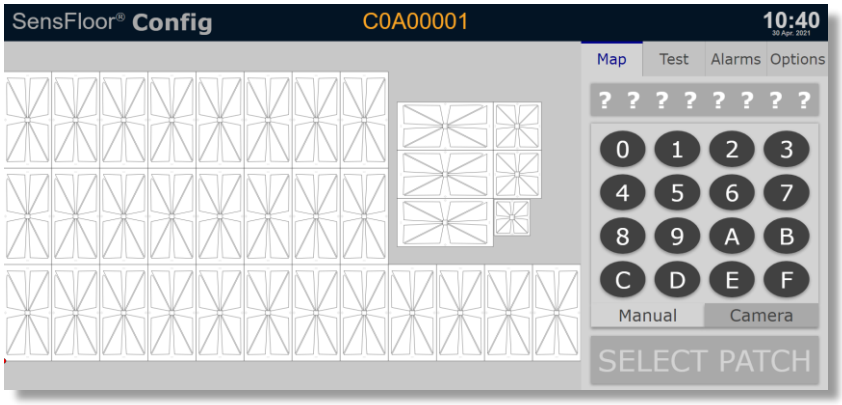


Fig. 11: Starting the mapping process. IDs can be entered on the keypad.

… or by means of a camera in the client device (the browser page may have to be reloaded to see the camera image). The procedure is to select the patches one by one in the layout (a selected patch turns from white to blue), to enter its ID and register it by tapping ***Assign New*** (see Fig. 12).
If an ID is chosen that was already assigned, ***Duplicate*** is displayed, and the two conflicting patches are marked in yellow. After tapping on the wrongly assigned patch, the ID can be changed by tapping ***Change***. By assigning 0 to a selected patch, it can be reset to the unmapped state at any time.

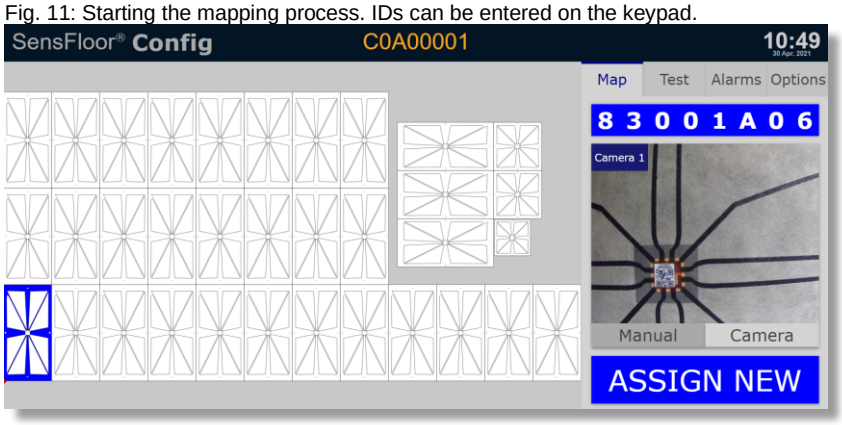


Fig. 12: Using the client's camera to read the ID from the QR-code label.

When the ID is assigned, the SE10 shows ***Configuring*** and tries to communicate with the sensor module of the patch (now coloured in purple) to check whether wireless data transmission works and whether all sensor fields show normal capacitance values. If that is the case, the module turns from purple to grey and the next module can be assigned. Modules that work correctly, directly show their sensor activity in the plan (yellowish sensor fields in Fig. 13).

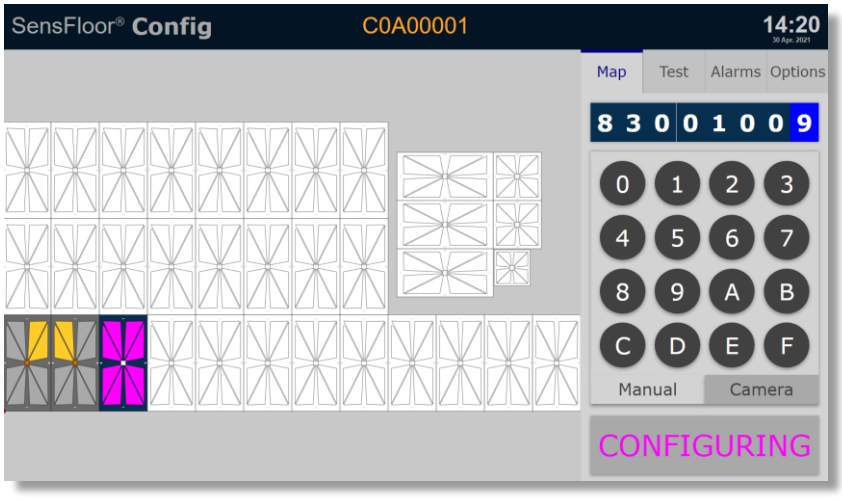


Fig. 13: The SE10 configures and tests the third patch. The first two patches were already assigned successfully. Assigned patches directly show sensor activity. **To protect the SensFloor, wear overshoes when stepping on the patches!**

When there is a problem with the communication or with the sensor fields, red dots indicate those fields which do not work correctly. In that case, the module must be checked for power problems, short circuit, connections between sensor fields or objects on the sensors. If the problems are found, the assignment can be retried (***Try Again***).
If the problem cannot be resolved, the patch must be replaced (refer to the SensFloor installation manual).

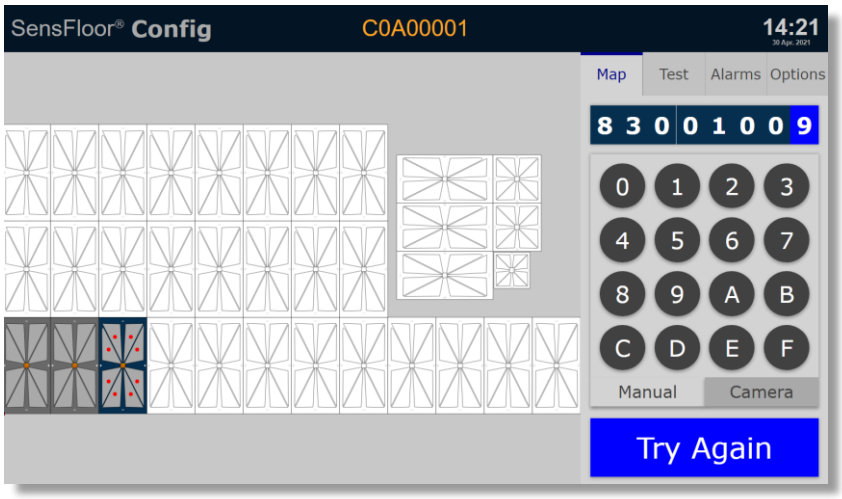


Fig. 14: Defective sensor fields are indicated by red dots.

Once all sensor modules are mapped correctly, they are all displayed in grey, and a window appears to offer the possibility to save a backup of the layout to the client device. The patches show the current capacitance when being activated. This way, the correct function of the installation can be verified by walking around.

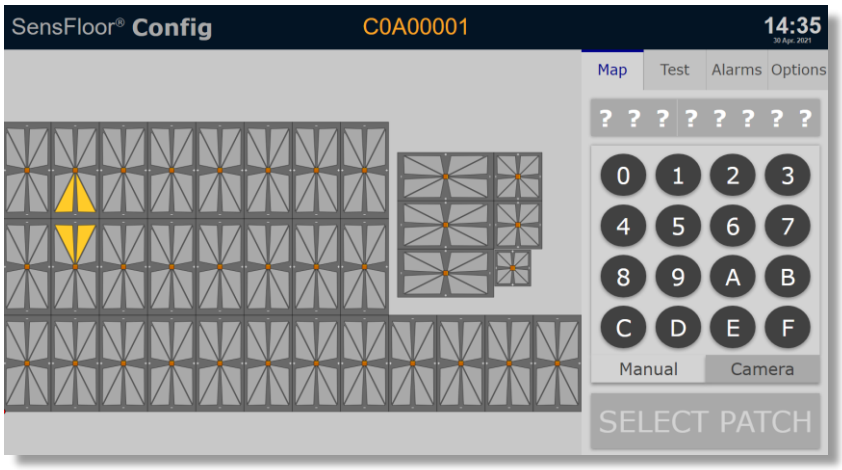


Fig. 15: All patches are successfully mapped.

As no floor covering is installed yet, special care must be taken to wear protective overshoes and not to step directly on the electronic modules!

4.1.3 Testing

Although each patch is tested during its assignment, it is **mandatory to run a test of the complete installation once the mapping process is finished!** This is done by going to the ***Test***-tab. When selecting a patch, its parameters like ID, coordinate, rotation angle and the capacitance of its sensor fields are displayed. By tapping ***Test All***, an automatic test run is started in which the SE10 communicates with each patch again to verify its functionality. To identify malfunctions, it is recommended to go through this procedure regularly, not only after installing the SensFloor and the floor covering.

During the test, the status of each patch is indicated by different colours: dark green means a successful communication with the sensor module, light green shows a positive test result. Red patches, however, indicate a problem. Malfunctioning sensor fields are indicated by red dots. If all sensor fields are marked with red dots, the entire patch may be broken and must be replaced. If only a single sensor field is broken and cannot be fixed, this will not have an influence on the overall functionality of the SensFloor. In this case it is possible to deactivate the field.

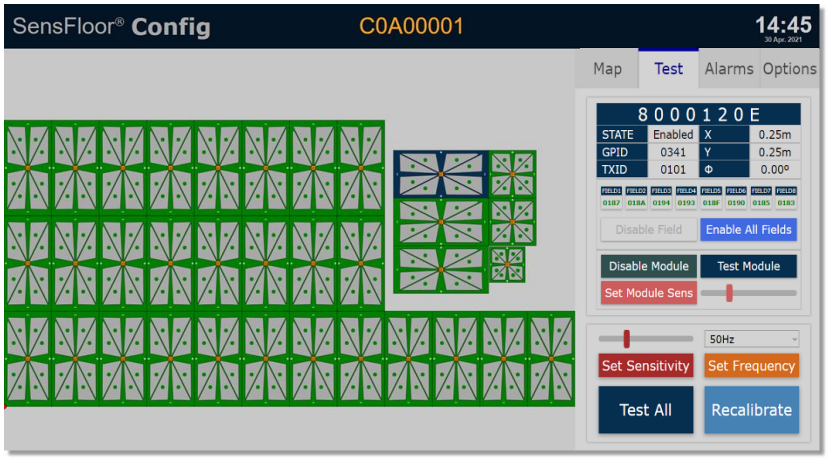


Fig. 16: Inspecting a patch's properties by selecting it in the Test tab.

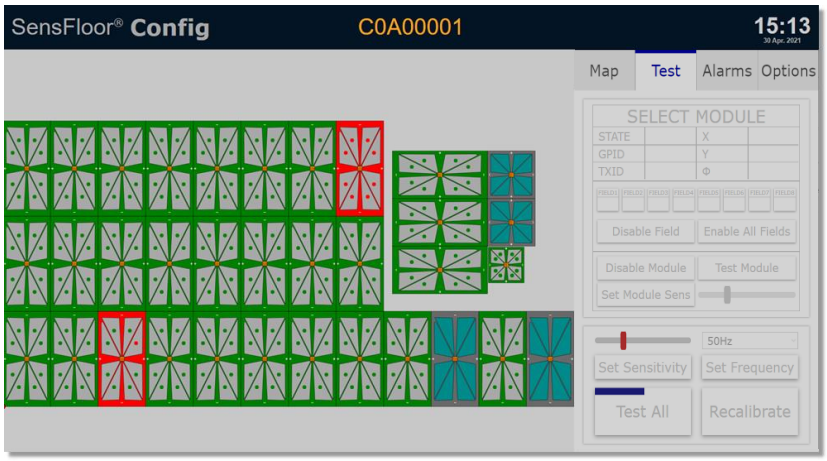


Fig. 17: Test run on the whole layout. Here, one complete patch and one sensor field is not woking correctly.

After the test run, perfectly working patches are shown in green, dysfunctional sensor fields are marked with a red dot and broken patches are indicated in red. When selecting a malfunctioning patch, the broken sensor fields show an abnormal base capacitance the value of which is highlighted in red as well. Tapping on that value marks the corresponding field(s) in orange which can be deactivated by tapping ***Disable Field***. If the malfunction can be rectified later on, the field(s) can be activated again by tapping ***Enable All Fields***. Deactivated sensor fields are greyed out in the layout (see Fig. 19).

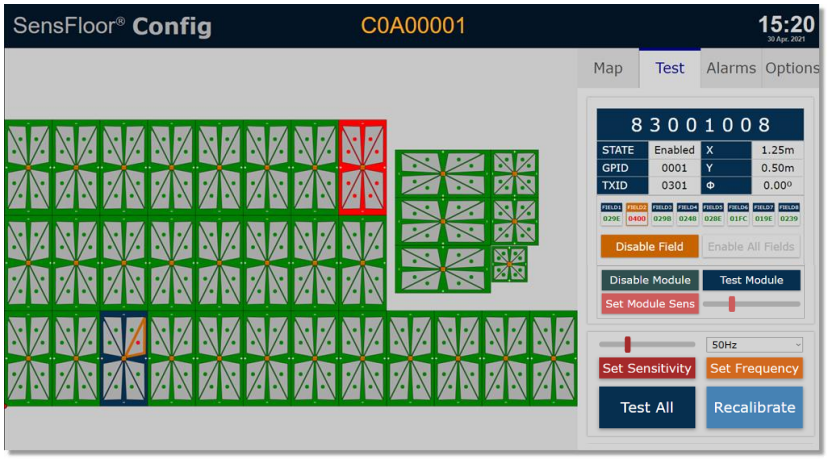


Fig. 18: Deactivating entire patches or single sensor fields.

When selecting an entirely broken patch, all its sensor fields are marked with red dots and show red values in their base capacitance. If a replacement is not desired or not possible, the complete patch can be deactivated by tapping ***Disable Module***. In this case, the complete patch is marked accordingly in the layout (see Fig. 19). The patch can be selected and activated again by tapping ***Enable Module***- The measurement of the capacitance depends on the local frequency of the mains power supply. This can be accounted for by selecting the frequency (50 or 60Hz) and tapping ***Set Frequency***.

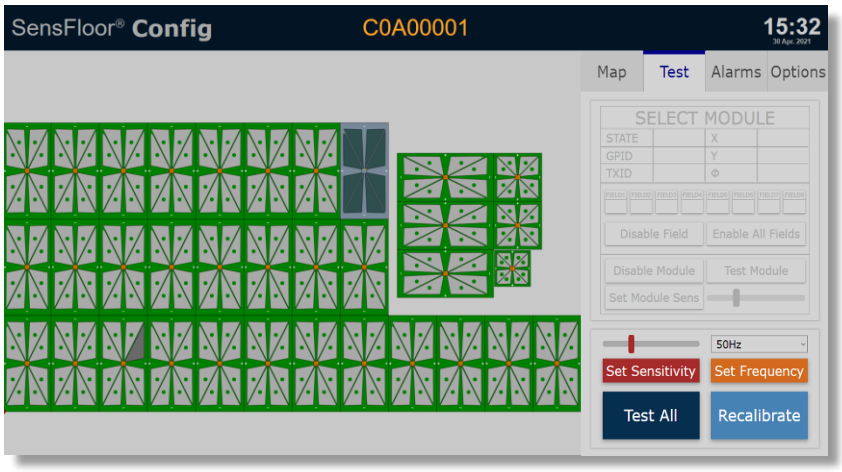


Fig. 19: One complete patch and one single sensor field are disabled.

Sometimes it may become necessary to reduce or to enlarge the sensitivity of the SensFloor. One reason to perform this step is when low sensor response is observed after installing or replacing the floor covering. By moving the slider to the right and tapping ***Set Sensitivity***, the sensitivity level of all modules is being increased one by one, which is indicated by a purple colour of the currently modified patch. For decreasing the sensitivity, the slider must be moved to the left.

Fig. 20: Changing the sensititvity level of the sensors.

In the same way, the sensitivity of a single module can be changed by selecting the module in the ground plan as in Fig. 16 and using the other slider and the button ***Set Module Sens***.

After installation of the floor covering and whenever furniture is being moved or replaced in the room, the SensFloor must be recalibrated to adapt to the new static capacitance. Tapping ***Recalibrate*** will shift the base activity level of the sensor fields such that static objects are being filtered out of the activity pattern. Therefore, this function should always be called when permanent changes to the physical configuration within the room have been applied or when permanent activity is being observed although no persons are in the room.

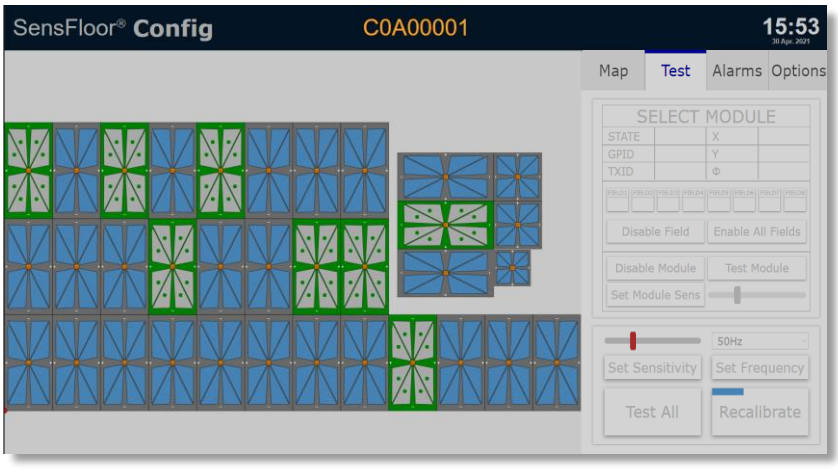


Fig. 21: Recalibrating the SensFloor.

The progress is indicated by the dark blue colour of the currently modified modules.

4.1.4 Creating a ground plan

When the room is equipped with furniture, the SensFloor layout can be enriched with graphical elements to make it look like a real ground plan. This process is started by going back to the ***Options*** tab and tapping ***New World***.

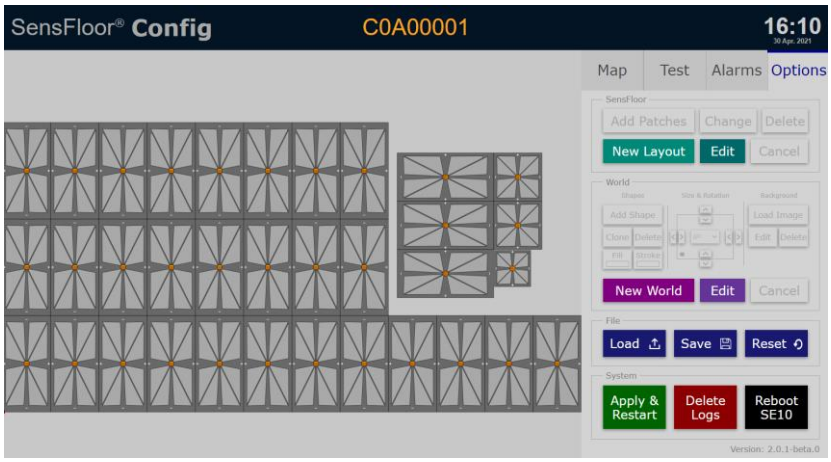


Fig. 22: The SensFloor layout can be enriched with graphical elements.

A window appears allowing for an automatic creation of walls around the layout to make it look like the ground plan of the real room.

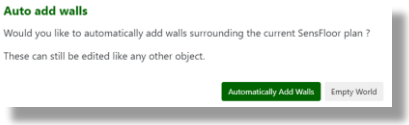


Fig. 23: Adding walls to the ground plan.

The walls, just like any graphical elements belonging to the world, can be changed in size and shape by selecting them and dragging the blue handles that appear.

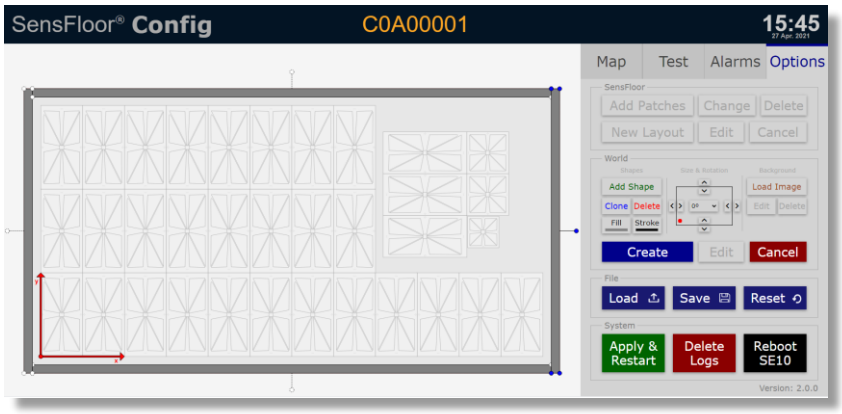


Fig. 24: Graphical objects can be changed by grabbing their handles.

By cloning, moving, rotating, and resizing the objects, elements like walls, doors and furniture can be created. By tapping ***Add Shape*** rectangles, ellipses or triangles can be chosen as base shapes.

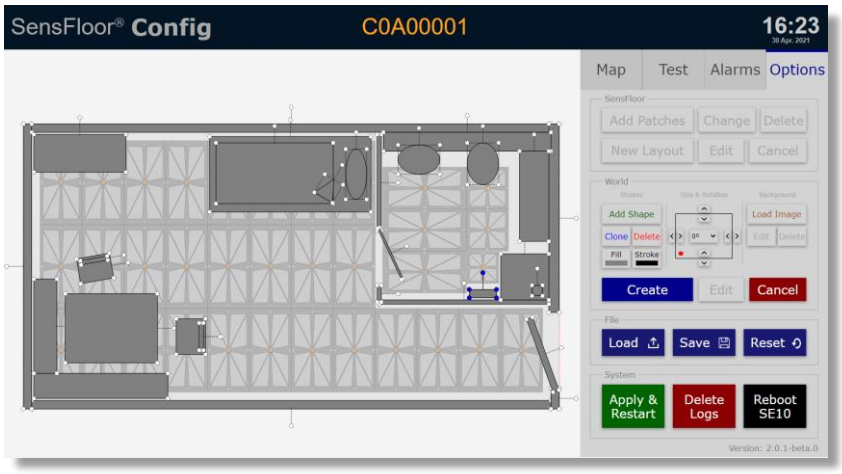


Fig. 25: Furniture, doors and inner walls can be created from base shapes.

By selecting an object and tapping ***Fill***, a colour pallet tool appears in which a fill colour can be chosen in various ways. The colour is applied to the shape when tapping ***Fill*** again. To colour multiple objects with the same colour, the pipette tool can be applied. The edges of objects can be coloured independently to achieve more contrast.

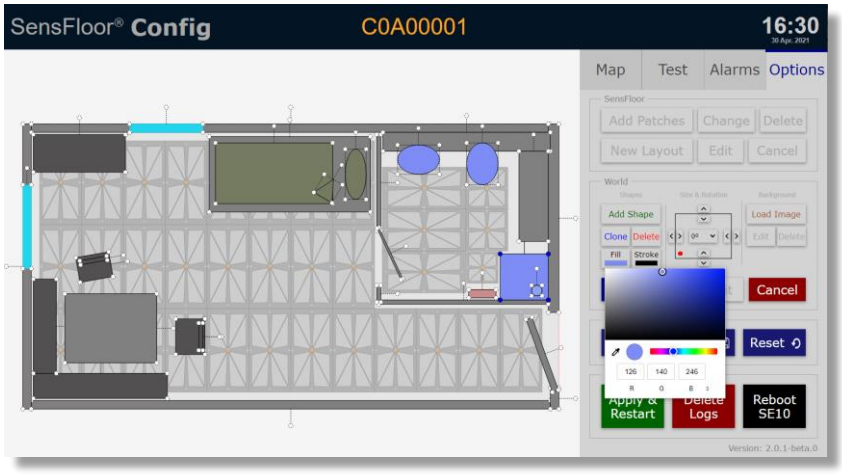


Fig. 26: Filling the shapes with color enhances the ground plan.

By means of the arrows in the ***Size & Rotation*** panel it is possible to scale the size of the whole ground plan in the visualization. When rotating the whole plan, the origin of the coordinate system rotates with the plan.
By tapping on ***Load Image,*** a background can be added to the world. By means of this function, a client's logo or an existing ground plan can be used instead of defining walls manually. The image file can be moved and resized until its scale fits to the scale of the layout. In Fig. 15 a light purple rectangle is used as background image. Only one image is supported which will appear as background in all apps.

Fig. 27: The whole ground plan can be scaled, rotated and underlaid with a transparent background image.

When everything is finished, the world can be saved by tapping ***Create***.
The world can be edited at any time by tapping ***Edit***. After edits, the world must be saved by tapping ***Safe***.
It is also recommended to download the current configuration to the client device again by tapping the blue ***Save*** button.

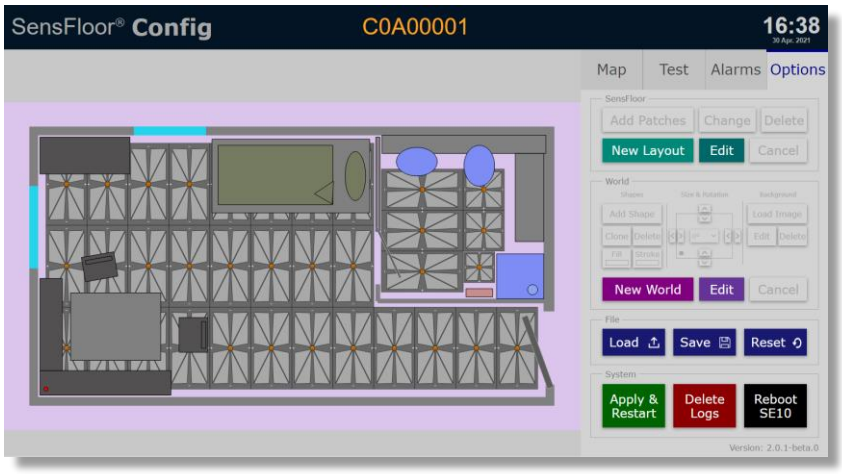


Fig. 28: The layout is finished and can be saved.

If multiple rooms have a similar ground plan, the configuration file containing the sensor layout and ground plan can be uploaded to other SE10s even before the mapping process is performed.
As objects like beds or furniture contained in the ground plan may hide sensor fields, the world layout is made transparent in the ***Map*** and ***Test*** tab as soon as a patch is selected (see Fig. 29).

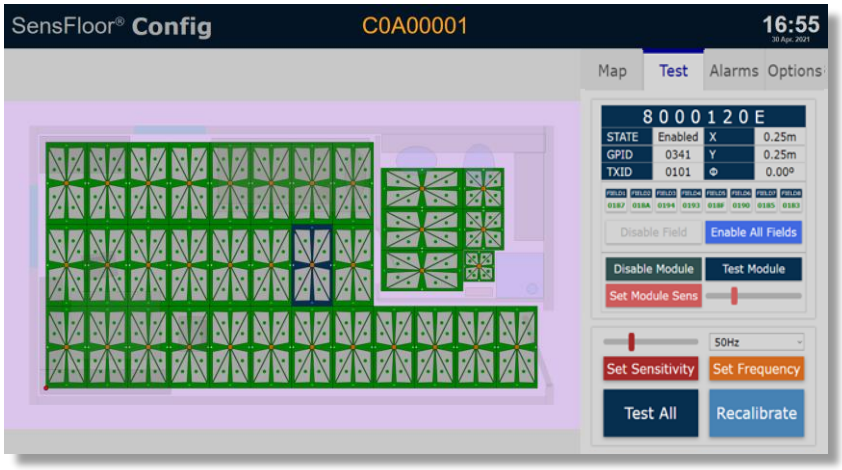


Fig. 29: The ground plan becomes transparent in the Map and Test tabs.

4.1.5 Configuring alarms and events

The way in which events on the SensFloor are treated can be configured in the ***Alarms*** tab. With the "+" and "x"-key, an infinite number of functions can be added or removed. After adding a new function, its type can be selected from a list. In the example in Fig. 30, ***Fall*** selects the fall alarm. This alarm is always pre-configured as a default initial alarm. To disable a function temporarily without removing its configuration, the ***Enabled*** switch can be used. Nevertheless, the information about the corresponding event is registered in the log files.

Fig. 30: Configuring alarms.

If an alarm is enabled, the ***Event***-switch controls, how the alarm is transmitted to external devices. If ***Event*** is off, only the relays associated to this alarm will be switched (see below). This can be used, for instance, to just activate an orientation light when a person gets up at night. If ***Even***t is on, the alarm will additionally be displayed on a connected ward terminal and can be processed by third party software through the API (refer to the corresponding manuals).

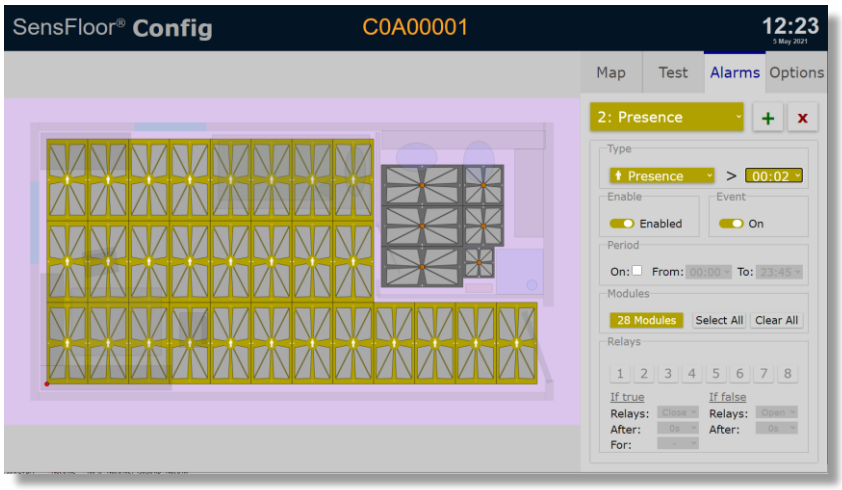
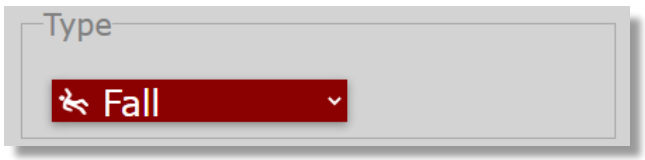


Fig. 31: Presence alarm in the living room with 2 seconds delay.

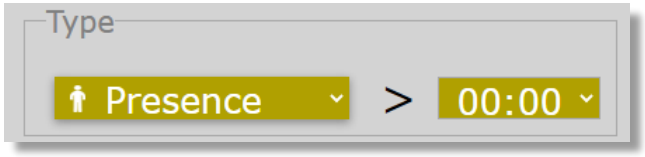
For any function, a time window (***Period***) can be selected in which it is processed. If no period is chosen, the function is always evaluated. If events shall be processed in specific areas only, the corresponding patches can be selected in the plan (see Fig. 31). As a shortcut, all or no module can be selected at once.

To facilitate the processing of an alarm/event by means of external devices such as an already existing building-automation system, nurse call system or light/sound indicators (e.g., an orientation light), the SE10 contains eight potential-free relay switches as described in section 3.1. The behaviour of these outputs as a response to an alarm/event can be configured in the ***Relay***-panel on the lower right. One or more relays can be chosen and delays (***After***) for switching on or off depending on whether the defined alarm situation is fulfilled (***If true***) or not fulfilled (***If false***) can be selected. It is also possible to change the relays' states automatically after a given time (***For***). This way, an orientation light can be switched on for a fixed time after a person has left the bed, for instance. It should be noted that the relays can only switch low currents of 100mA each. For switching higher currents, additional external contactors are required. The following table lists the basic functions:

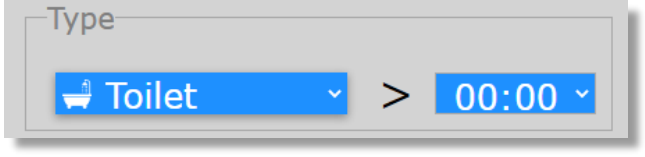
Fall: a person lies on the floor in the configured region.



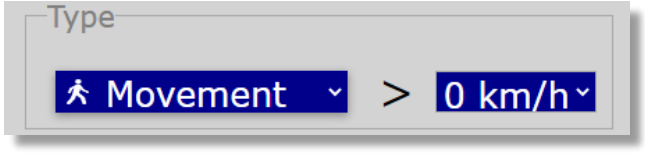
Presence: one or more persons are present in the configured region for longer than the indicated time selectable between 0 and 2 minutes. The delay can be used to ignore short events like nurse visits.



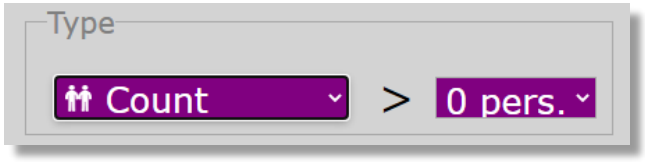
Toilet: a person is present in the toilet for longer than the indicated time (minutes/seconds). This is like ***Presence*** but is indicated with a dedicated bathroom-symbol to highlight presence at this special location.



Movement: one or more persons move in the configured region faster than the indicated speed selectable between 0 and 9 km/h. This can be used to filter out static activity.



Count: more than the indicated number of persons, selectable between 0 and 30, are present in the configured region. By choosing 1, the presence of a nurse in addition to the patient can be detected, for instance.



A characteristic to pay attention to when configuring alarms is that some events, like the ones above, are active as long as the situation does not change. However, other events are *transient* by design. The state of the ***Bed In*** and ***Bed Out*** events (see below), for instance, is *true* for only a short time.

Some events require the definition of one or more ***regions*** in the plan. An example is the event ***Bed In*** which requires the selection of the area around the bed. A region is added by means of ***Add New*** and then dragging a rectangle starting out from a point within the SensFloor area.
The event is detected when the object representing a person disappears from the SensFloor at a location within the selected region. For the ***Bed In*** event this is true when the person goes to bed because he/she generates no more activity on the SensFloor.

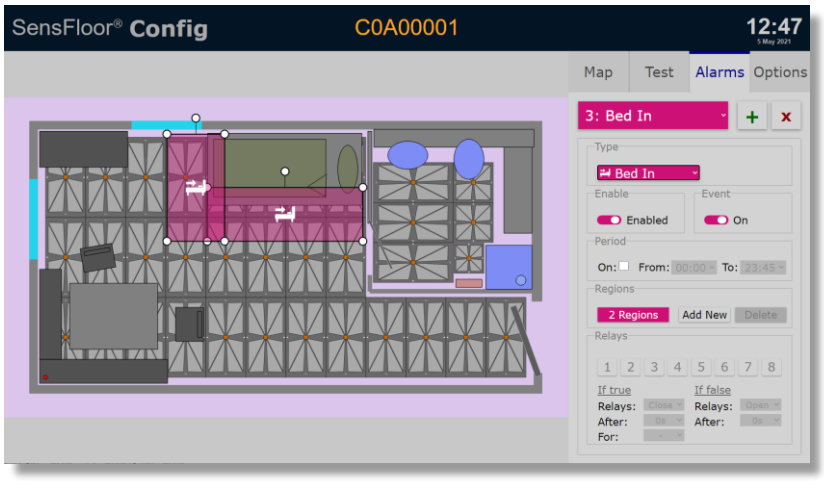


Fig. 32: Defining the regions for the ***Bed In*** event.

Therefore, it is important not to leave a gap between the regions and the bed but to even extend the regions a bit towards the area under the bed as in Fig. 32. Otherwise, there is a risk that the person's feet are lifted from the SensFloor at a location outside the defined area, which would not trigger the ***Bed In*** event!

A nurse just visiting a sleeping patient will not generate a ***Bed In*** event, as she leaves the region towards the room without disappearing from the SensFloor in general.

When defining a ***Bed Out*** event, the same regions are used. However, the event is only triggered when the object/person *appears* in one of the defined regions and then leaves the region towards the rest of the SensFloor area. This way, a ***Bed Out*** event is not triggered when a person just puts the feet out of the bed before putting them back in again. A nurse visiting a sleeping person will also not trigger a ***Bed Out*** event even when she leaves the region because she has appeared on the SensFloor at a location outside the bed-regions. This way, the algorithm prevents false classifications of events. However, this implementation may also make the system behave in an undesired way. For triggering an automatic night light, for instance, the function ***Bed Out*** is not the right one to choose as the light will not be switched on immediately when putting the feet on the floor but only after few steps. Much better is to choose the ***Presence*** function within the full SensFloor area in combination with the night as time window. This way the light will be activated during the night as soon as activity is detected on the floor.

Whereas ***Bed In*** and ***Bed Out*** are events within one and the same room, there are other functions that deal with transitions between two different rooms. When configuring these functions, an important question is whether there is SensFloor in both rooms or just in one of the two. For instance, the corridor in front of the apartment may not be equipped with SensFloor. In that case, the parameter ***Without SF*** must be chosen together with the event. In Fig. 33 the ***Room Out*** event is triggered, when the person vanishes from the SensFloor within the selected region.

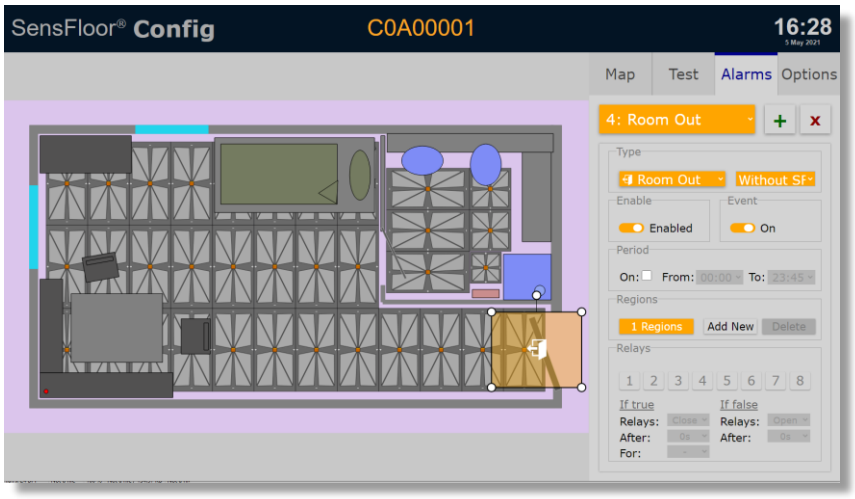


Fig. 33: Configuring the Room Out event without SensFloor in the hallway.

In Fig. 34, however, there is SensFloor on both sides of the door. In that case, the person would not disappear from the SensFloor when going into the bathroom. For these situations, the parameter ***With SF*** must be chosen. The ***Toilet In*** event is triggered, when the person crosses the white line in the direction indicated by the white arrows. The rotation handle can be used to turn the region in the right orientation between the rooms.

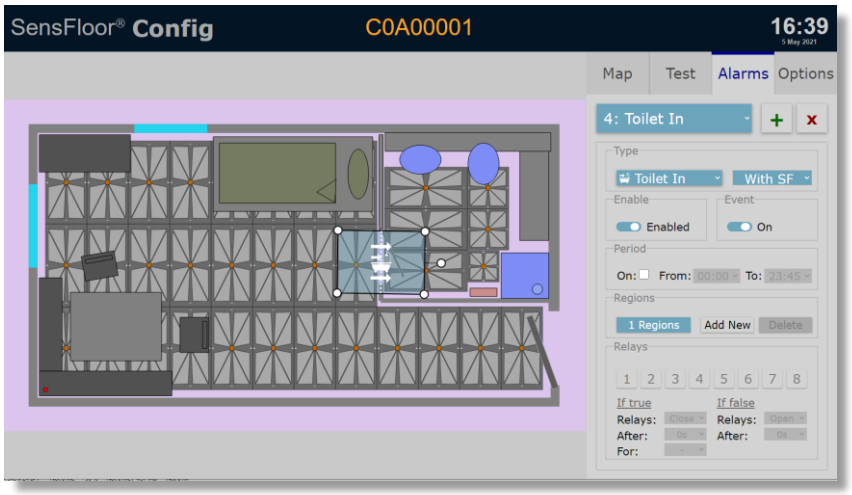
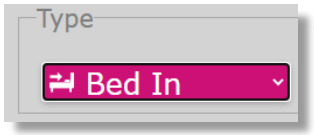


Fig. 34: Configuring the Toilet In event with SensFloor in the bathroom.

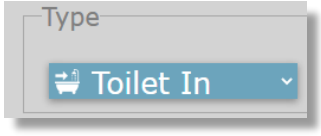
Alarms and events that require a definition of one or more regions are summarized in the following table:

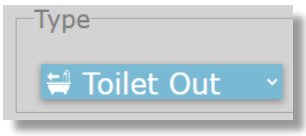
Bed In/Bed Out: a person goes to bed / leaves the bed



Bed Timer: at least the indicated time (from 15 minutes to 24 hours) has passed since the last ***Bed In*** event without a ***Bed Out*** event occurring.

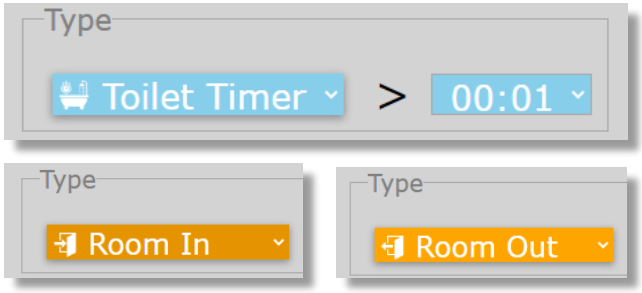
Toilet In/Toilet Out: a person enters / leaves the bathroom. For these events, the options ***With*** or ***Without SF*** are available.





Toilet Timer: at least the indicated time (from 1 minute to 2 hours) has passed since the last ***Toilet In*** event without a ***Toilet Out*** event occurring. This is an important function to detect when a person is immobile in the bathtub for a long time.

Room In/Room Out: a person enters / leaves the apartment. For these events, the options ***With*** or ***Without SF*** are available.



The SensFloor Care system allows for the integration of up to 3 external sensors other than the SensFloor itself.
As a requirement, these sensors must provide a potential-free output (dry contact) that can be connected to the input pins of the Raspberry Pi's extension port. A state change of an external sensor (***Open/Closed***) triggers the corresponding event. As the external sensor is independent from the state of the SensFloor, the SensFloor layout is greyed out during the configuration.

Fig. 35: Configuring an external Sensor.

Once all alarms/events are configured, the configuration should be saved by tapping ***Save*** in the ***Options*** tab.
It is important to know that only those alarms/events can be controlled from a SensFloor Care ward terminal that have been defined in the corresponding SE10 room terminal.
To make the changes known to all other apps apart from ***Config***, the apps must be restarted by tapping ***Apply & Restart***. After about 45 seconds, the GUI is restarted automatically.

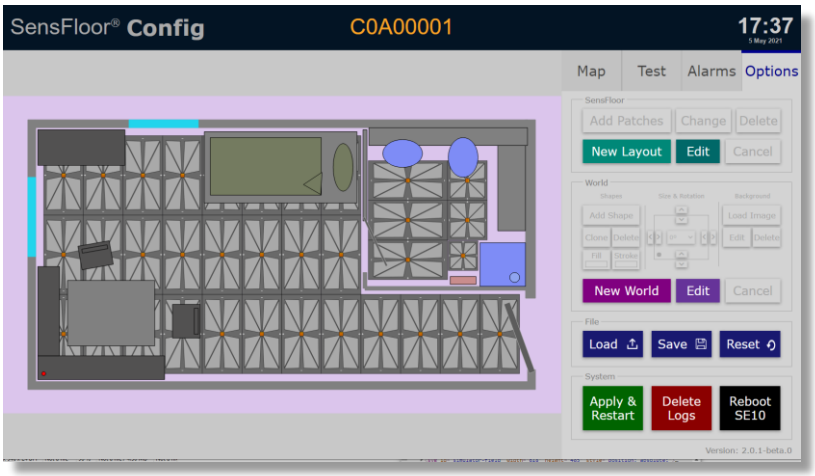


Fig.36: Saving the configuration and restarting the apps.

4.2 Live: Display current activity on the SensFloor in real time

In the “Live” app the current activity on the SensFloor is displayed in detail. The app can be accessed through the port 8000: http://192.168.5.5:8000 (or the IP address assigned by the router).

In the default configuration, the Live app shows the ground plan with the SensFloor layout and the activity of the triangular sensor fields as different shades of yellow. Neighboring fields are fused into ***Clusters***, that are fused into ***Objects*** which are shown as circles. When the objects are moving, a ***Trail*** of their previous path (*trajectory*) is displayed, and their ***Speed*** is indicated as number and as varying color. Note that objects can fuse and split depending on the distance of their clusters.

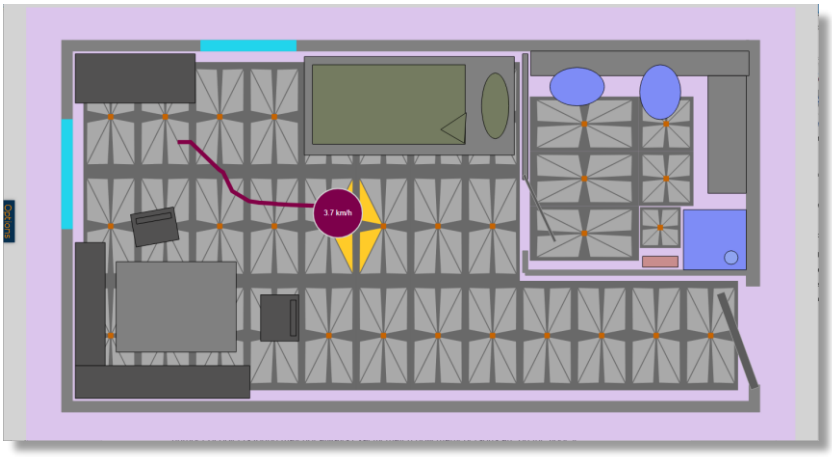


Fig. 37: Live display of a person walking on the SensFloor.

Also note that, although the algorithm is fine tuned to track people standing or walking on the floor, the number of objects found may not always exactly match the number of persons on the floor.
When tapping on the ***Options*** icon on the left edge, a panel slides in that allows for changing several parameters of the display. In Fig. 38, the ***SensFloor*** layout, the ***Activity*** of the sensors, the trail and the speed of the objects are hidden by unticking the corresponding boxes. When the speed display is removed, fixed individual colors are assigned to separate objects.

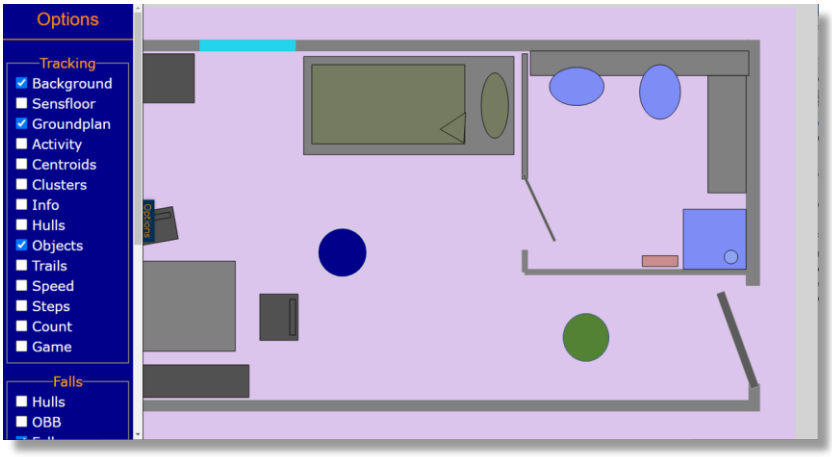


Fig. 38: Deactivating the display of elements in the live view. Two people are represented by two differently colored circles.

To understand how the clustering algorithm works, it is possible to display the ***Centroids*** of the active sensor fields (dark dots) the weighted average of which defines the coordinate of a cluster’s center. In Fig. 39, the cluster with the ID zero is shown. Further information about this cluster can be displayed by ticking the box ***Info***. The ***age*** is the time in seconds that has passed since the cluster’s first appearance on the sensor area.

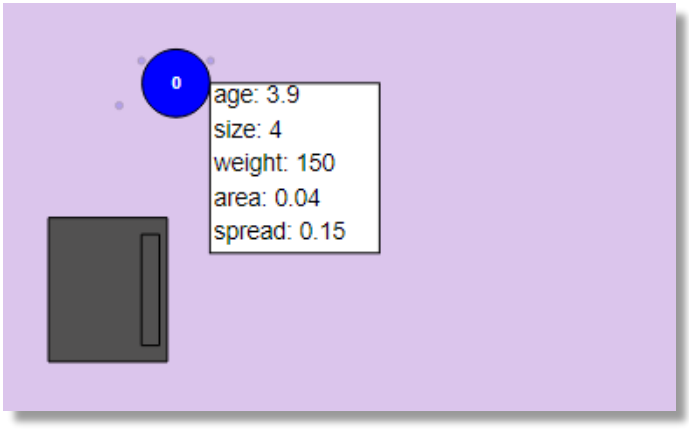


Fig. 39: Information about the cluster that contributes to an object.

When a person lies on the floor, a characteristic sensor pattern of high capacitance amplitude is produced. If the option ***Falls*** is ticked, the SE10's fall detection algorithm recognizes this pattern and indicates a fall as purple polygon (***Hull***) with the size of the fall pattern at the corresponding location. Simultaneously, the background turns red.
To get an idea about the orientation of the person on the floor, a green *bounding box* can be displayed around the polygon by ticking ***Boxes***.

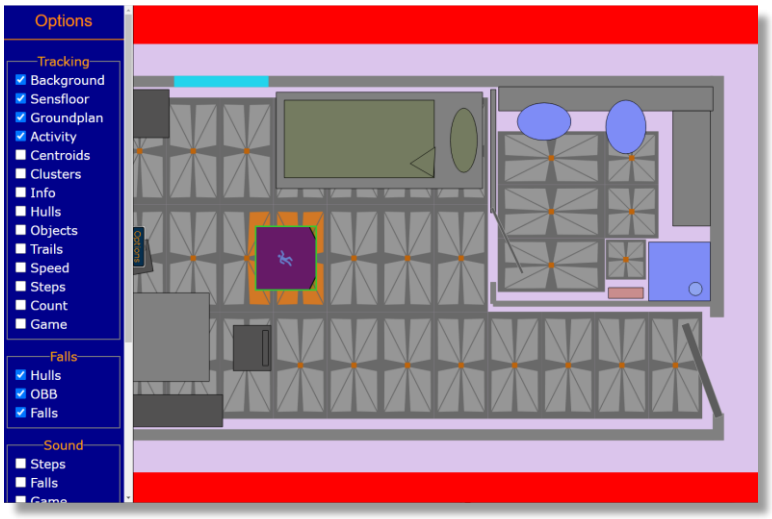


Fig. 40: Indicating the activity pattern and location of a fall.

When ticking the corresponding boxes for ***Sound***, acoustic signals accompanying the events are sent to the HDMI output. In the example in Fig. 41, sound is activated for ***Fall*** and ***Steps***. In combination with the option ***Steps*** under ***Tracking***, the latter will indicate every step on the SensFloor by means of a tone and a flashing white bubble at the position of the current footstep.
The selection under ***Rendering*** allows for different levels of smoothness of moving objects in the display. For large SensFloor installations with many simultaneously moving objects, the selection ***Fastest*** may be required.

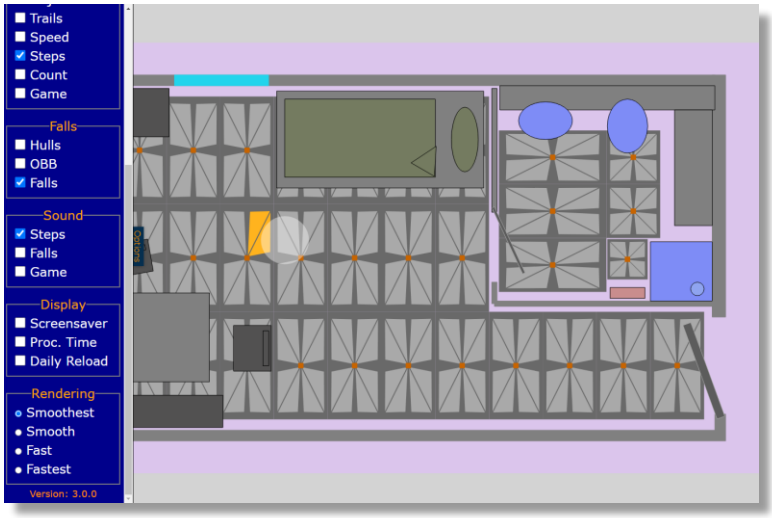


Fig. 41: Indicating footsteps by means of sound and white bubbles.

When ticking the box ***Game*** in the ***Options*** tab (the option ***Objects*** must be active too), a simple chasing game is displayed. The task is to walk towards five targets placed at random positions one after the other. Once a target is hit, the next one appears. The score is the user's speed calculated from the time it took to walk the distance between the targets. The ***High Score*** can be reset by clicking the reset symbol to its right. As the targets may be hidden under furniture, this game is best played in open spaces equipped with SensFloor and a monitor. The game can be used to stimulate elderly people physically as a measure for preventing frailty.

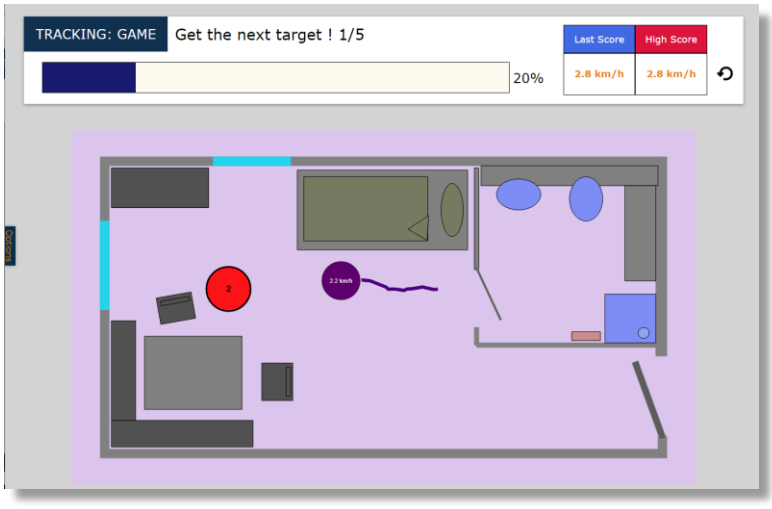


Fig. 42: Simple chasing game.

When ticking the option ***Count*** in the ***Options*** tab, an experimental interface appears that can be used to count transitions of people between four areas (A-D). The position and size of the areas is pre-defined and can only be changed by the manufacturer for customer-specific applications. Under ***Tracking: Count***, the number of people that have already crossed the areas is shown for specific selections of regions (e.g., 2 from entrance A to any exit B, C or D) and as a matrix for all possible combinations. The count can be reset automatically after one day or one week and a list of all transition events can be exported as ASCII file with time stamps to the client device by clicking the diskette icon.

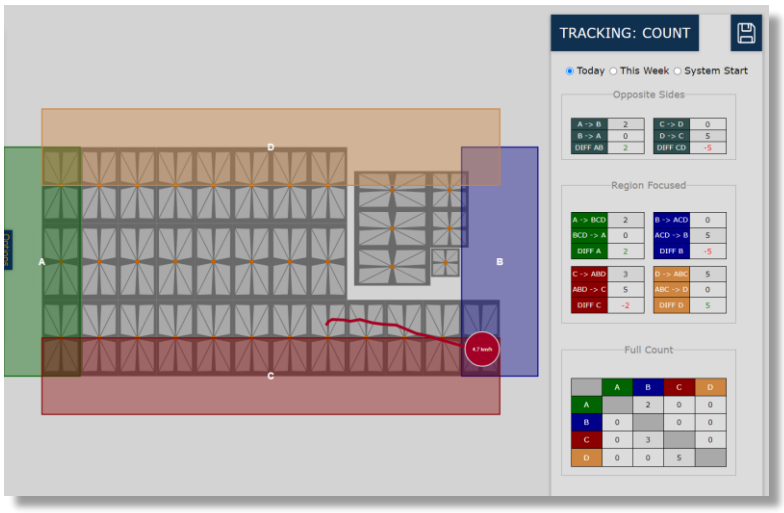


Fig. 43: Experimental counting feature.

If the ***Live App*** is shown permanently on a monitor either connected directly to the HDMI-port of the SE10 or to a client that runs a web browser, it is possible to present a slide show for the time that no activity is detected on the SensFloor by ticking ***Screensaver*** in the ***Options*** tab. By default, the slide show is a presentation of the SensFloor Care System. As soon as the SensFloor or a connected mouse/touchscreen registers activity, the ordinary ***Live App*** is displayed again.

For permanently connected displays it is recommended to activate the ***Daily Reload*** option in the ***Options*** tab which will reload the page in the underlaying browser once a day.

By ticking ***Proc. Time***, a processing time can be displayed from which the system's load can be derived. This function is for debugging purposes only.

By ticking ***Relays***, the current state of the SE10's relays is indicated in the lower right corner

4.3 Activity: Displaying the history of activity on the SensFloor

For many applications it is interesting to know what has happened on the SensFloor in the past. This information can be obtained by means of the app ***Activity*** that can be accessed through the port 8001: http://192.168.5.5:8001 (or the IP address assigned by the router).

In contrast to the ***Live App***, the ***Activity App*** allows for an analysis of the activity in a room over a longer period in the past. This way, changes in the health status of persons can be discovered and tracked. It is also possible to obtain statistical information about the frequency of events and alarms. Detailed information about which movements directly preceded a fall, for instance, can be gained by using the ***Playback*** function.

4.3.1 The Overview Function

The Activity App analyses SensFloor data in time periods within a date range. A period consists of a configurable time window between one minute and twenty-four hours.

For instance, if you wish to look at data for the ten first days of January 2021, you can choose the date range as 01.01.2021 – 10.01.2021, and the time window as 00:00 – 23:59. However, if you only want to look at mornings during those days (i.e., to generate morning reports), you can select the time window to be only 07:00-12:00. Furthermore, if you want to look at nights, the time window can be chosen as 22:00-06:00.

Note that in this last case, the (night) period includes two different days.

Time periods within the date range can be further filtered by selecting which weekdays to include (e.g., to exclude weekends from the analyses.

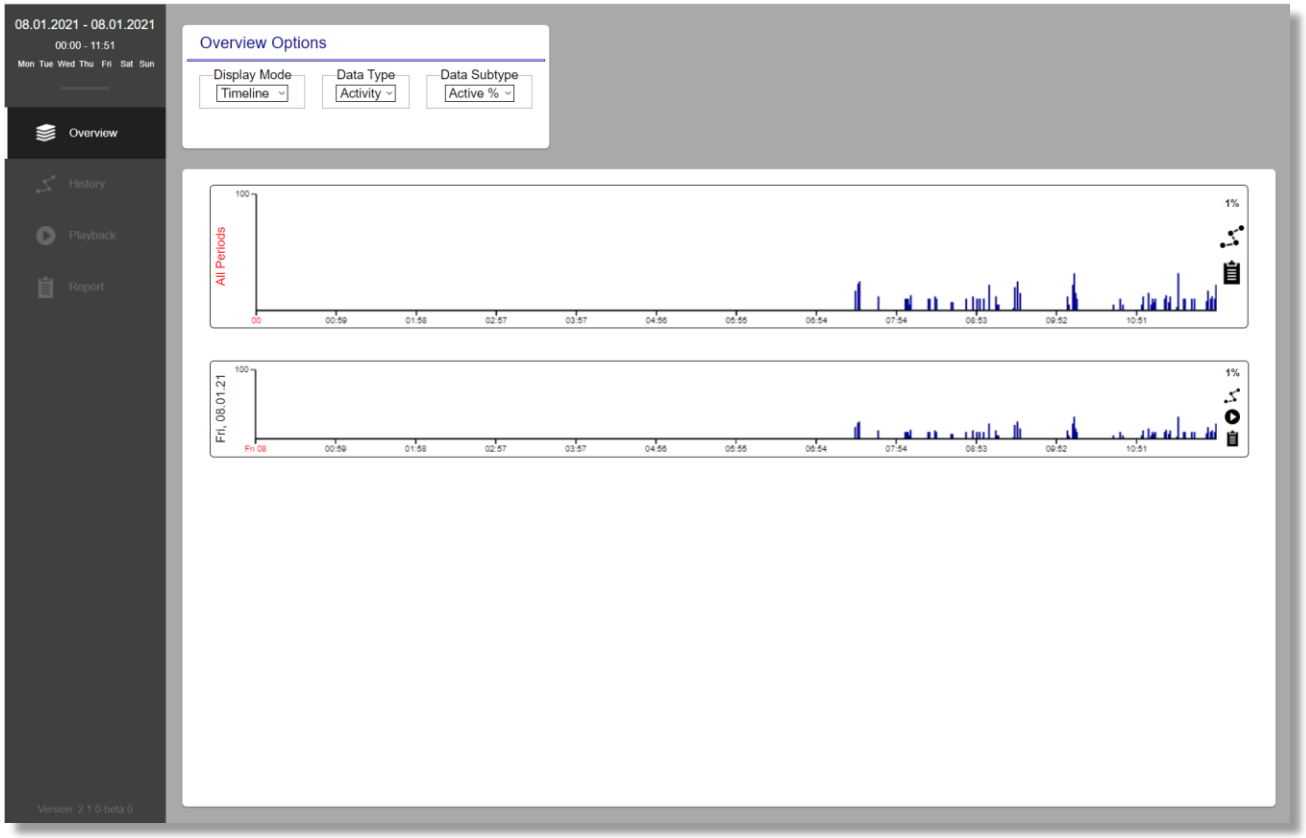


Fig. 44: Overview displaying the activity in a room during a selected period.

The default view is an ***Overview*** over the activity in the corresponding room. The activity is displayed as bar graph over a *period* the details of which are displayed in the upper left part of the history window. By default,

the predefined period is the current day from midnight up to the current moment. In Fig. 44 the period starts at midnight January 8th and ends at 11:51am on the same day.

By clicking on the period selection area, a ***Calendar View*** appears which allows for the selection of the desired periods. By clicking on the date rage, a start and end date can be selected (Fig. 45 left lower panel), and by changing the start and end time, the period's time-window can be chosen. (Fig. 13 right upper panel).

If the analysis is to be limited to specific weekdays within the selected date range, weekdays can be selected (black) or removed (grey) by clicking on them in the ***Week Days*** panel (Fig. 45 lower right).

After the desired time window and date range is selected, the data must be extracted from the log files stored on the room terminal. This can be achieved in two ways: by clicking on ***Get Activity Data***, only activity information and alarms are extracted whereas clicking on ***Get Location Data*** also captures the position of the objects (i.e., the persons) on the floor. The first, quicker method is sufficient to obtain statistics about falls or other events, while the second, slower method can be used to track the movement of people, e.g., shortly before a fall occurred. If location data has been extracted, the color of the timeline data changes from black to blue.

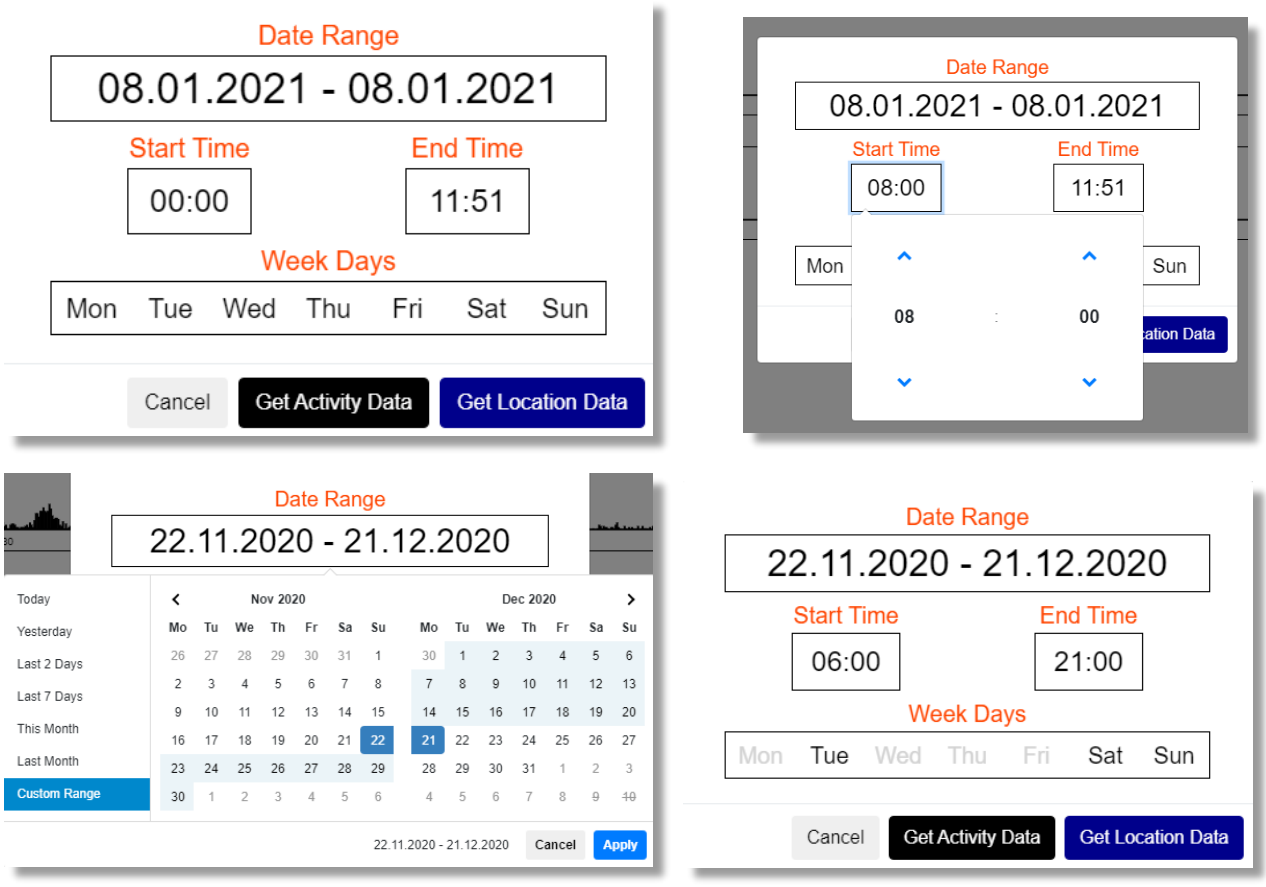


Fig. 45: Selection of a period and a set of days for which location- or activity data of a specific room shall be analyzed. In this example data in the period between 06:00 and 21:00 of all Tuesdays, Saturdays and Sundays between November 22 and December 21, 2020 have been selected.

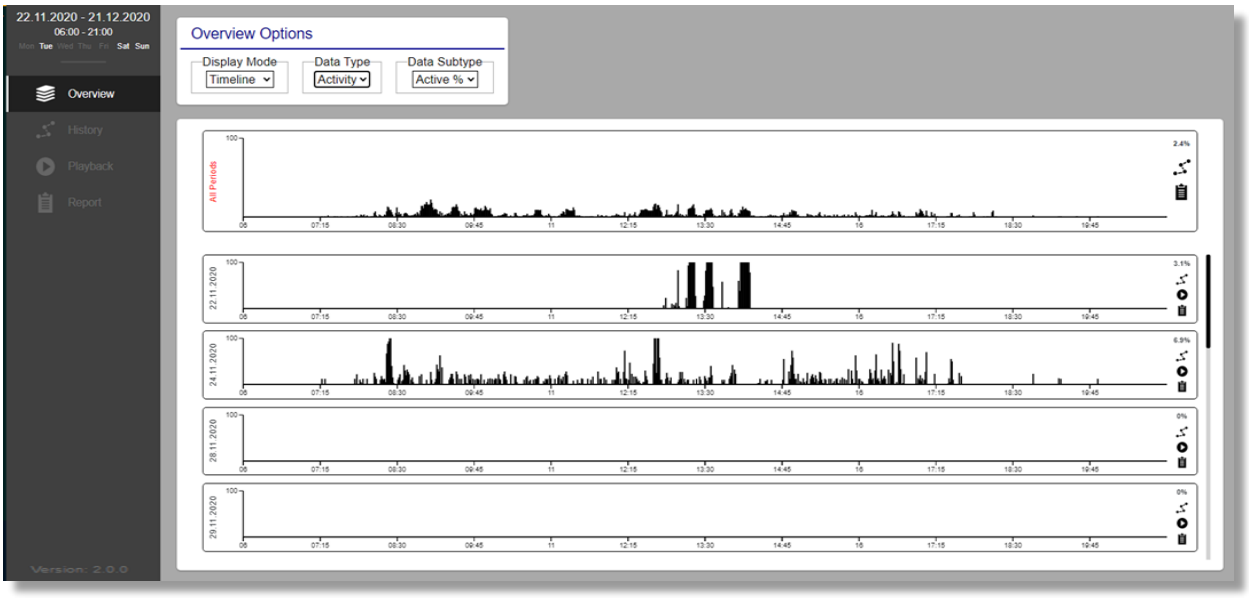


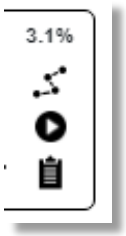
Fig. 46: Scrollable list of bar graphs for the selected period and set of days.

As can be seen in the example of Fig. 46, by default the activity within each period is displayed as bar graphs in a scrollable list for every period within the selected set of days. In addition, the activity accumulated over all the periods is displayed in the first bar graph on top of the list (***All Periods***).

By means of this visualization, the variation of activity from period to period can be analyzed. In the example of Fig. 46, for instance, the graphs are empty before 7am and after 6:30pm because the person was in bed at that times. By means of the graph of accumulated activity, variations averaged over many periods reveal routines such as getting out of bed or breakfast time.

The horizontal width of each bar corresponds to an interval of 1 minute, which is, therefore, the temporal resolution of the time series. By default, the height of each bar in the periods shows, which fraction of that minute activity was registered by SensFloor. When, for instance, from the 60 seconds only for 30 seconds there was activity on the floor, the corresponding bar would go halfway up to 50% activity. In the accumulated plot, the percentage is divided by the number of periods such that the bar can only reach 100% when in every period there was permanent activity in that very minute.

The average activity is displayed as percentage in the right upper corner of each period's graph. The other clickable symbols in the right edge of the plot are shortcuts to the ***History-***, ***Replay-*** and ***Report-***Functions that will be explained in the next sections. In any case, the data of the corresponding day (or from the accumulated **A*ll-Periods*** plot) is pre-selected for the analysis within those functions.



By default, the bar graphs show the activity on the SensFloor over time as relative number (***Active%***). For rooms equipped with SensFloor this information already provides a rough estimate about the resident's general health status as a low activity level during the night and a normal level during the day indicates a relaxing sleep and a good physical status.

In addition to the relative activity, other indicators can be selected in the ***Overview Options*** (see Fig.47). When changing the ***Data Subtype*** into ***Objects***, the graphs show the number of objects that were present on the SensFloor over time. Usually, this corresponds to the number of persons, however, also moving metallic objects or other objects which change the capacitance are counted here.
The subtype ***Distance*** shows the distance in meters that were covered by the objects while being on the SensFloor. This information is interesting when analyzing the movement behavior of residents, for instance.

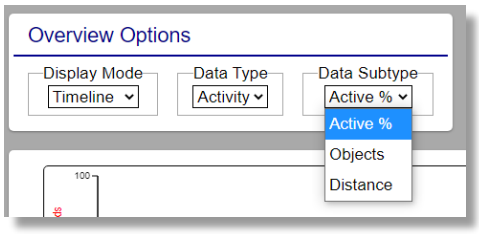


Fig. 47: Default Overview Options.

For an individual analysis, the comparison of the figures over a longer date range is more meaningful. To facilitate this, the ***Display Mode*** can be changed from ***Timeline*** (i.e., the bar graphs) to a calendar view (see Fig. 48). Here, the values for activity, distance, objects etc. averaged over the selected date range are indicated for each day of the chosen set of days. Days with zero values are indicated as empty white squares to highlight this fact. By means of this plot, changes in certain indicators can be spotted easily.
The example in Fig. 48 shows, for instance, that on Nov. 24 and Dec. 1 the covered distances in the SensFloor area were much larger than on the other days.

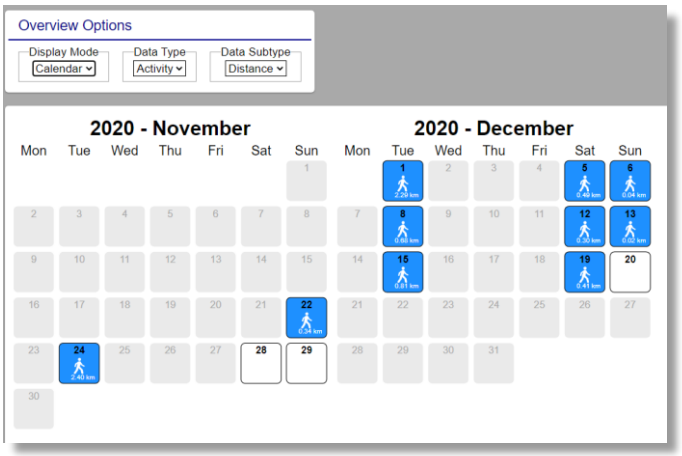


Fig. 48: Calendar view. Days not belonging to the set are greyed out.

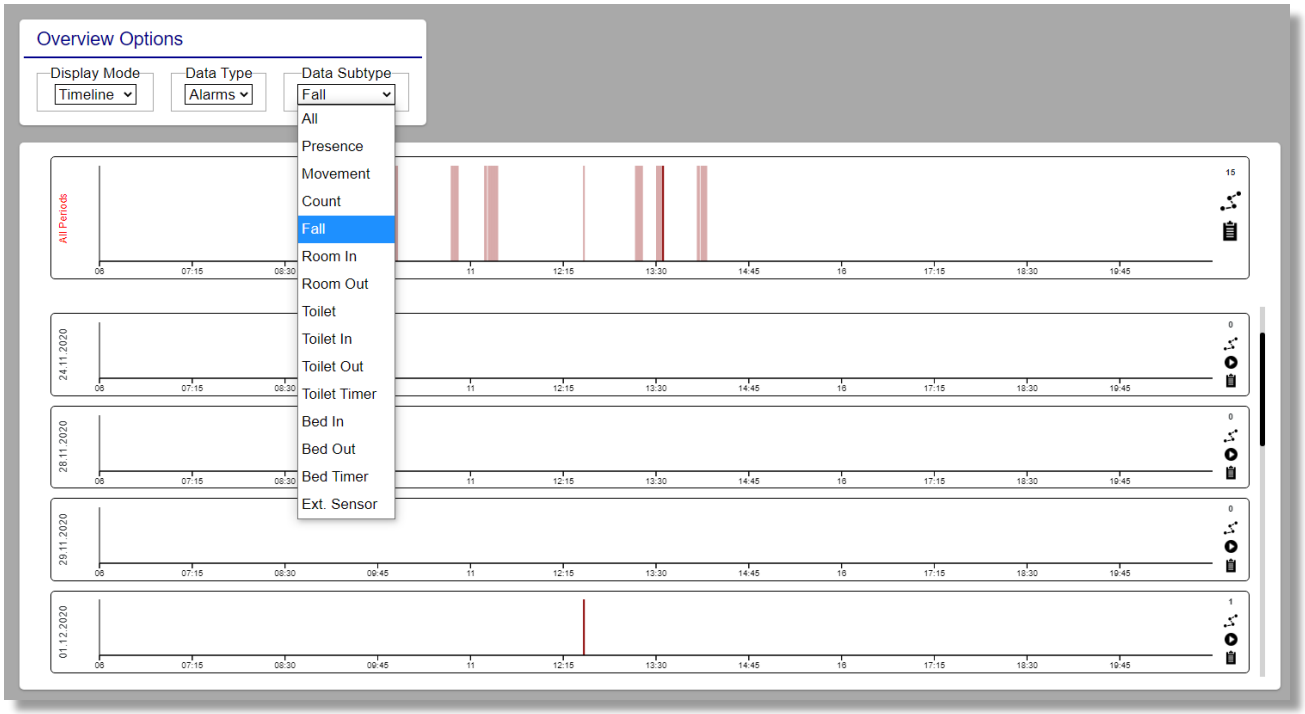


Fig. 49: Timelines of alarms.

The ***Data Type*** can be changed from ***Activity*** to ***Alarms***. In this case, any type of alarm (or all alarms at once) can be selected as subtype. Depending on the configured alarms (see section 4.1.5 and Fig. 49) this allows for a detailed analysis of the events in a specific room. In the example of Fig. 49 the first timeline shows that on the selected periods over all 15 falls have happened between 8:30 and 14:45. The timeline of Dec. 1 indicates one fall at 12:20.

The ***Calendar View*** reveals that there were falls on five days of the selected 13 days with a peak of 6 falls on Nov. 22.
By selecting meaningful events and comparing the development of the occurrence of these events over a long time, changes of the health status of individuals can be tracked even more precisely than with the activity graphs alone.
By analyzing the number of ***Bed Out*** events at night, for instance, diseases that prevent a person from a relaxing sleep can be revealed.
This data representation can also facilitate the documentation process together with the ***Report*** function (see below).

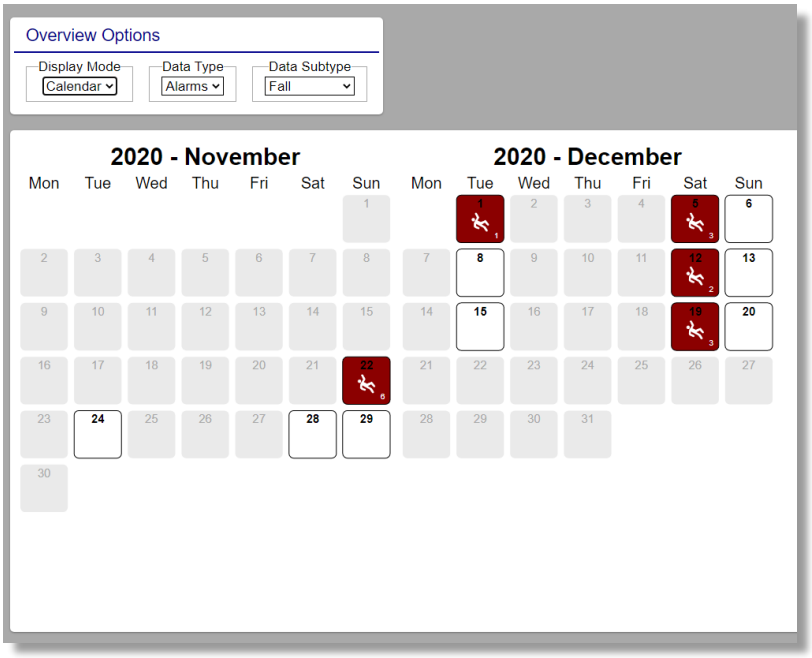


Fig. 50: Calendar view of fall alarms.

4.3.2 The History function

Whereas the overview function described before is used to obtain statistics about activity and events over a set of days, the history function allows for a more detailed analysis of single periods or even single events. When clicking the history icon at the right edge of the timeline of Dec. 1 in the overview (Fig. 49), for instance, the data of this day is displayed in the history view (Fig. 51).

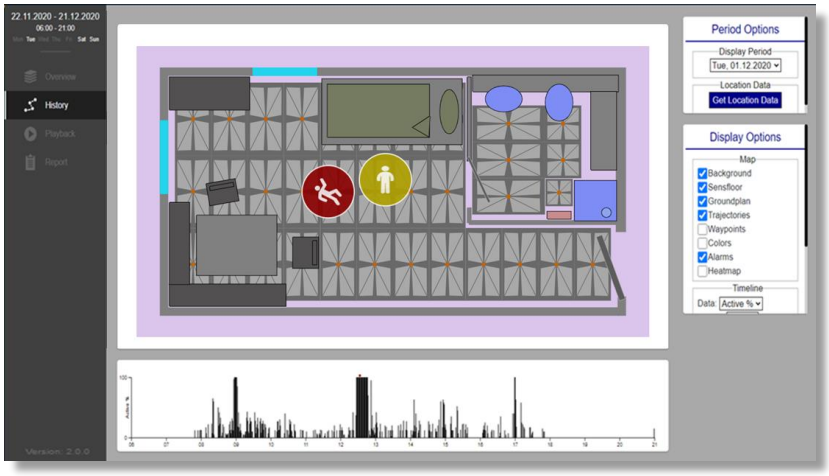


Fig. 51: History view of one day's period.

The timeline with the activity data is shown at the bottom. Its black color indicates that only event data has been extracted so far. Consequently, the fall that occurred on this day around 12:20, is indicated as red dot in the timeline and as fall-icon in the ground plan of the room. Any other alarms/events that have occurred in this period, are also displayed in the ground plan using the icons introduced in section 4.1.5.

Under ***Period Options*** in the upper right corner, it is possible to change the period of interest to another one from the set. If it has not already been done in the overview, the location data for this period can be extracted by clicking on ***Get Location Data***. The color of the timeline data will turn to blue and as long as the option ***Trajectories*** under ***Display Options*** is active, the pathways of all objects/persons during the period are drawn in the ground plan (see Fig.52).
By means of activating or de-activating other display options, further information can be displayed or removed.

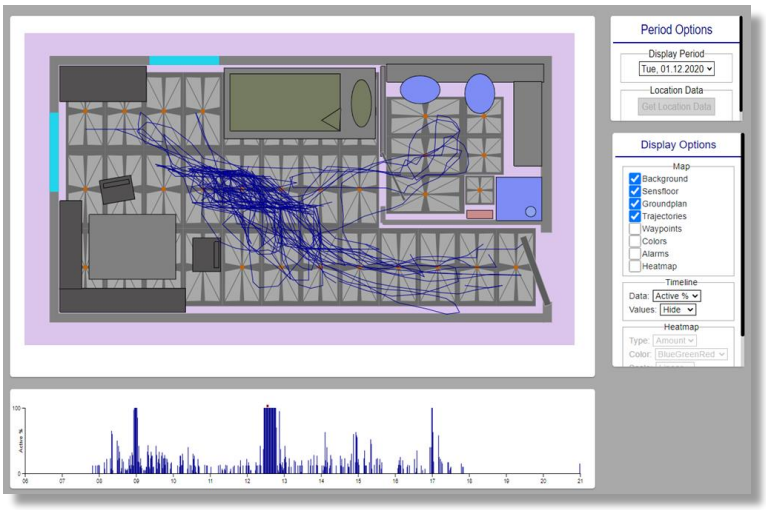


Fig 52: Pathways (trajectories) are shown in the ground plan.

By activating the ***Colors*** option, for instance, the trajectories of different persons are plotted in different colors so that they can be distinguished. The indication of the location of the alarms and events by means of their icon in the ground plan can be switched on and off using the ***Alarms*** option. The option ***Waypoints*** displays triangles where an object has left the area and circles where an object has entered.

The bunch of trajectories gives an impression about the preferred *pathways* that people use in the SensFloor area. To investigate preferred *locations*, the ***Heatmap*** feature can be activated in the display options (see Fig. 53). Depending on the ***Type*** selection, either the accumulated ***Amount*** of activity or the ***Time*** of presence at a location is displayed as a color-coded map of ***linear*** or ***logarithmic*** scaling.

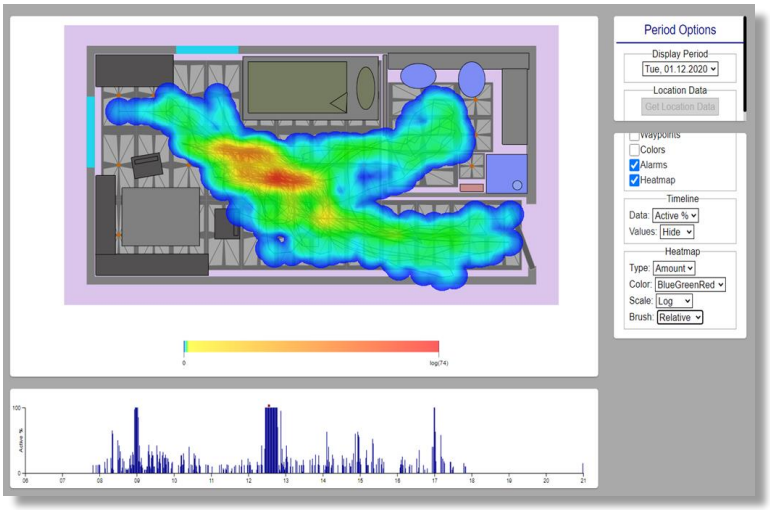


Fig 53: Heatmap: color-coded image of preferred locations.

To analyze events more closely, it is necessary to zoom into the time window around the event. This can be accomplished by dragging a rectangle around the time of the event in the timeline either using a mouse or by means of a dragging gesture on the touch screen and then pressing the *magnifying glass* icon on the top right of the timeline (see Fig. 54).

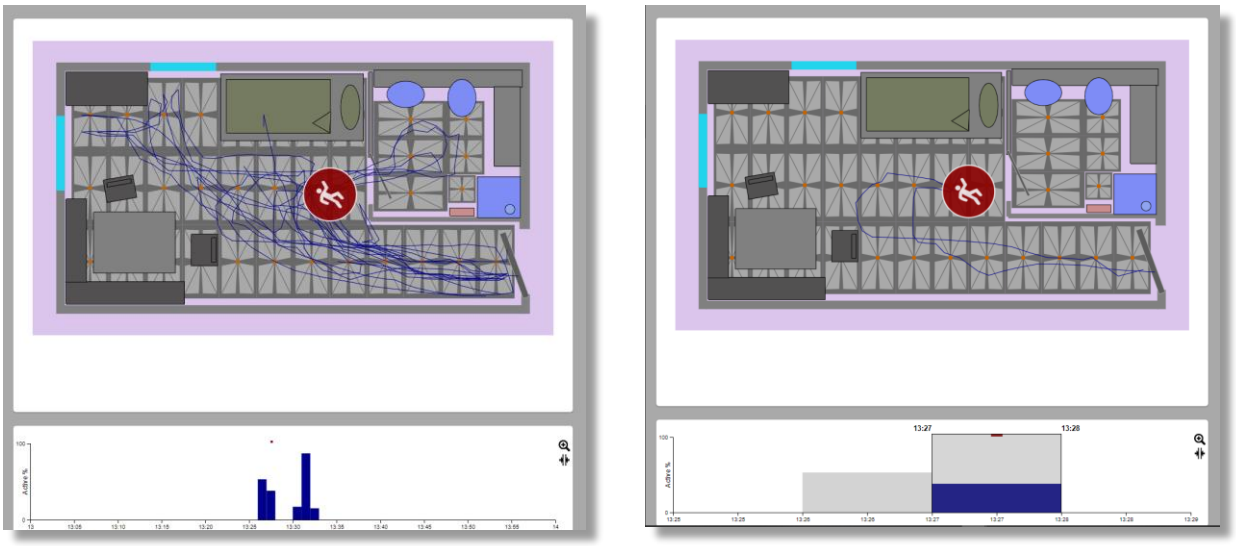


Fig. 54: Zooming into the time window around a fall event.

This procedure can be repeated until the minimum time-bin of one minute fills the complete timeline. As only those trajectories are plotted in the ground plan that fall into the highlighted time-bin, the pathway that led to the fall can be investigated in detail. By clicking on the *limits*-icon under the magnifying glass icon, it is possible to return to the timeline of the full period at any time.

It is important to note that not only the trajectories but all display options, such as ***Waypoints*** and ***Heatmap***, refer to the current selection in the timeline. This way, those representations can be analyzed around interesting alarms/events as well.
By default, the heatmap is normalized over the whole timeline (***Brush***-option ***Relative***). To normalize the color scaling to the selected time window only, the brush option ***Absolute*** can be chosen (see Fig. 55).

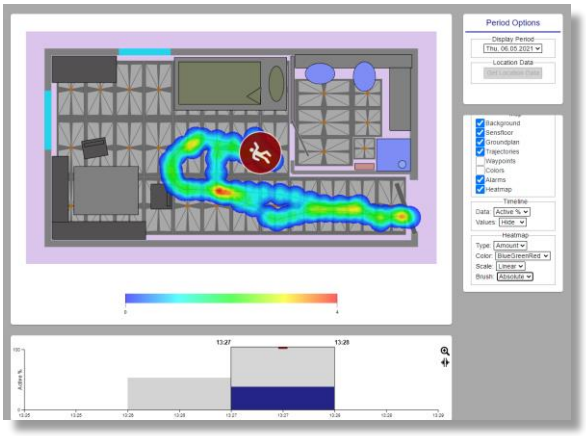


Fig. 55: Heatmap limited to the time window around the fall.

4.3.3 The Playback function

To investigate the dynamic aspects of certain alarms and events, these can be replayed by means of the playback function (Fig. 56).

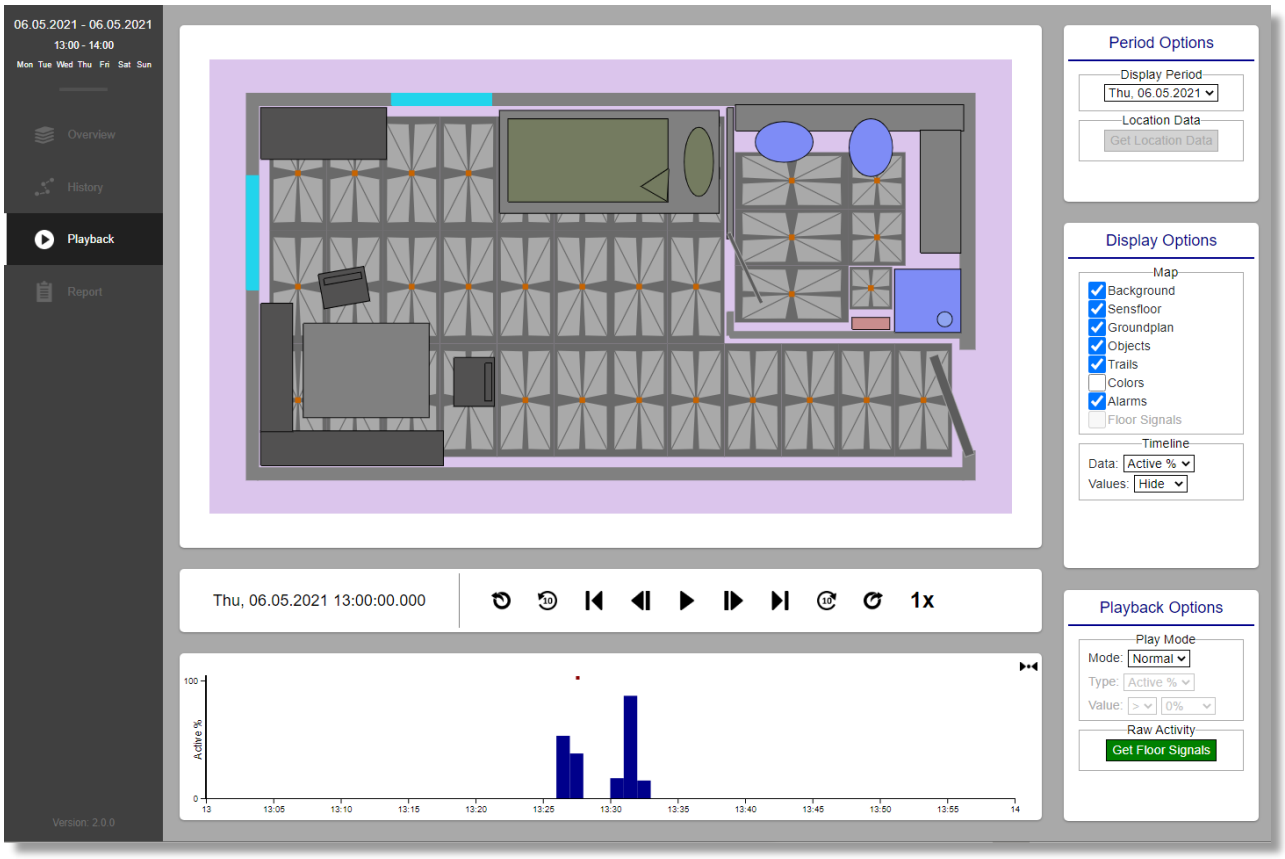


Fig. 56: Default GUI of the playback function.

Below the ground plan a panel with videorecorder-like controls is shown. Whereas the ***Period Options*** are the same as in the ***History*** Function, the ***Display Options*** have slightly changed, and a new ***Playback Options*** Panel appears.

When the playback button ▶ is pressed, the timestamp left of the controls starts to run in red color and a red time cursor moves across the timeline (see Fig. 55).
Any activity that is reached by the cursor is displayed in the ground plan as if it were live. ***Objects*** (persons) are represented by blue dots and their recent paths are shown as blue ***Trails*** in the ground plan. Both visualizations can be switched off in the ***Display Options***.
By activating the ***Colors*** option, every object and its trail is shaded in a different color, so that they can be distinguished.

Fig. 57: Playback is running.

It is even possible to show the raw sensor signals after downloading them from the log file by pressing ***Get Floor Signals*** on the lower right of the screen. Depending on the width of the selected time window, the amount of data can be large, so the extraction process takes a while. After it is finished, the color of the data in the timeline changes to green to indicate that raw sensor data is available. Due to the large data set the zooming options are not available as the processing would be too slow. This state is indicated by a red lock symbol in the timeline. The zoom lock can be released at any time by clicking on the lock symbol which will discard the raw sensor data from analysis.

Fig. 58: Using the ***Floor Signals*** option.

When the ***Floor Signals*** option is activated and the raw sensor data is available, the sensor fields (grey triangles) obtain a shade of orange depending on the activity induced by people walking across the floor. This way it is also possible to identify sensor activity induced by other objects or liquids on the floor.

In large time windows, it may be hard to find the events of interest quickly. Therefore, there is a set of further playback controls:

▶ ⏸	Play and pause
◀▮ ▮▶	Jump back and forth 0.1s. This is best used in pause mode to analyze in fine steps
⏮ ⏭	Jump to the start/end of the selected time window
↺10 ↻10	Jump back and forth 10 seconds
↺ ↻	Jump to the previous/next appearance of a new object/person. This function is very handy to jump over periods which contain no activity
0.1x , 1x , 20x	Change playback speed to slow motion, real time, or time lapse

Fig. 59: Playback controls

Another possibility to find interesting periods is to use the ***Seek Mode*** available by clicking on the symbol ▶◀ in the upper right corner of the timeline panel. When seek mode is enabled, this symbol becomes red, and the time cursor changes into a dotted line. In this state, no zoom windows can be dragged but instead the time cursor can be grabbed and moved manually across the timeline. As the corresponding events are displayed synchronously in the ground plan, this allows for a very fast search for interesting events. If the right position is found, the mode can be changed back to normal by clicking on the symbol again.

Another useful way to scan a wide time window quickly is to change the ***Play Mode*** from ***Normal*** to ***Skip*** in the ***Playback Options***. When using ***Play*** in this mode, periods without any activity will be skipped automatically. The ***Playback Options*** do also allow for a filtering of the timeline by using the ***Play Mode Filter***. In this mode it is possible to filter the data in the timeline for periods with a given ***Value*** of maximum or minimum relative ***Activity*** or ***Objects***. One application of this function is, for instance, to look for periods in which a second person (e.g., a nurse) was present in a room together with a patient (see Fig. 60). The data can also be filtered for specific ***Alarms*** by setting the options ***Type*** and ***On*** accordingly.

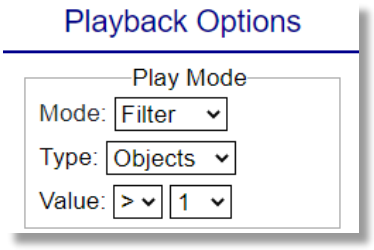
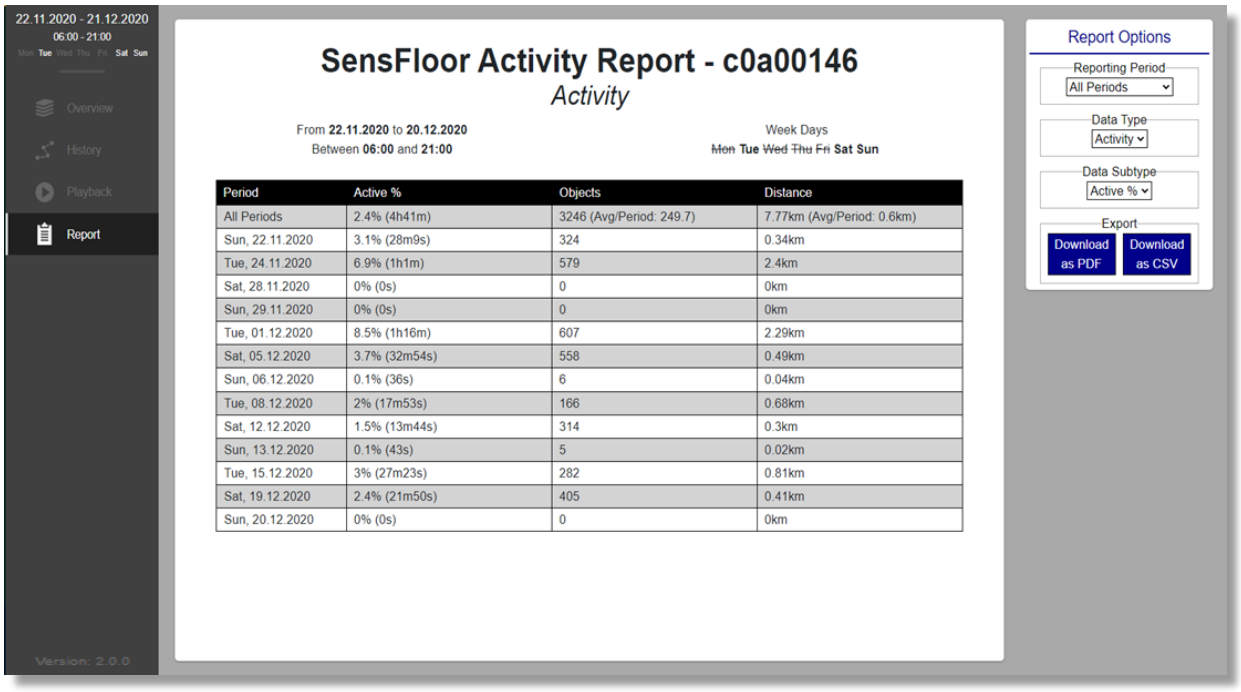


Fig 60: Playback options to filter for periods with 2 or more persons present.

4.3.4 The Report function



Period	Active %	Objects	Distance
All Periods	2.4% (4h41m)	3246 (Avg/Period: 249.7)	7.77km (Avg/Period: 0.6km)
Sun, 22.11.2020	3.1% (28m9s)	324	0.34km
Tue, 24.11.2020	6.9% (1h1m)	579	2.4km
Sat, 28.11.2020	0% (0s)	0	0km
Sun, 29.11.2020	0% (0s)	0	0km
Tue, 01.12.2020	8.5% (1h16m)	607	2.29km
Sat, 05.12.2020	3.7% (32m54s)	558	0.49km
Sun, 06.12.2020	0.1% (36s)	6	0.04km
Tue, 08.12.2020	2% (17m53s)	166	0.68km
Sat, 12.12.2020	1.5% (13m44s)	314	0.3km
Sun, 13.12.2020	0.1% (43s)	5	0.02km
Tue, 15.12.2020	3% (27m23s)	282	0.81km
Sat, 19.12.2020	2.4% (21m50s)	405	0.41km
Sun, 20.12.2020	0% (0s)	0	0km

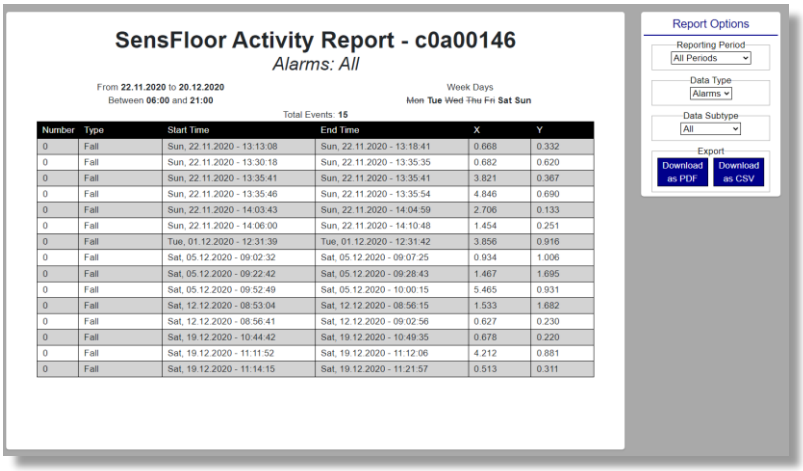
Fig. 61: Report of the selected period and set of days.

The report function offers a spreadsheet-like representation of the activity, alarms, and events of the corresponding room's SensFloor installation over the selected period within the chosen set of days (see Fig. 61). By default, all days of the set are listed but by means of selecting a ***Reporting Period*** in the ***Report Options*** it is possible to show just a single day. When the default ***Activity*** is set as ***Data Type***, the table shows the relative activity in % and the total active time in the first column. The second column shows the number of objects (persons) per day and the third column displays the overall distance walked by all persons.

When changing the data type to ***Alarms***, the list shows all types of alarms and the time when and the location where they occurred (see Fig. 62).

This list can be filtered for specific alarms by changing the ***Data Subtype*** accordingly. Consequently, when no alarm of the selected type has ever happened, the list remains empty.

The coordinates of the alarm locations are given relative to the coordinate origin of the corresponding room's SensFloor installation, that was selected in the configuration GUI of the room terminal at installation time.



Number	Type	Start Time	End Time	X	Y
0	Fall	Sun, 22.11.2020 - 13:13:08	Sun, 22.11.2020 - 13:18:41	0.668	0.332
0	Fall	Sun, 22.11.2020 - 13:30:18	Sun, 22.11.2020 - 13:35:35	0.682	0.620
0	Fall	Sun, 22.11.2020 - 13:35:41	Sun, 22.11.2020 - 13:35:41	3.821	0.367
0	Fall	Sun, 22.11.2020 - 13:35:46	Sun, 22.11.2020 - 13:35:54	4.846	0.690
0	Fall	Sun, 22.11.2020 - 14:03:43	Sun, 22.11.2020 - 14:04:59	2.706	0.133
0	Fall	Sun, 22.11.2020 - 14:06:00	Sun, 22.11.2020 - 14:10:48	1.454	0.251
0	Fall	Tue, 01.12.2020 - 12:31:39	Tue, 01.12.2020 - 12:31:42	3.856	0.916
0	Fall	Sat, 05.12.2020 - 09:02:32	Sat, 05.12.2020 - 09:07:25	0.934	1.006
0	Fall	Sat, 05.12.2020 - 09:22:42	Sat, 05.12.2020 - 09:28:43	1.467	1.695
0	Fall	Sat, 05.12.2020 - 09:52:49	Sat, 05.12.2020 - 10:00:15	5.465	0.931
0	Fall	Sat, 12.12.2020 - 08:53:04	Sat, 12.12.2020 - 08:56:15	1.533	1.682
0	Fall	Sat, 12.12.2020 - 08:56:41	Sat, 12.12.2020 - 09:02:56	0.627	0.230
0	Fall	Sat, 19.12.2020 - 10:44:42	Sat, 19.12.2020 - 10:49:35	0.678	0.220
0	Fall	Sat, 19.12.2020 - 11:11:52	Sat, 19.12.2020 - 11:12:06	4.212	0.881
0	Fall	Sat, 19.12.2020 - 11:14:15	Sat, 19.12.2020 - 11:21:57	0.513	0.311

Fig. 62: Report of alarms.

When clicking on ***Download as PDF***, the currently visible spreadsheet is converted into a pdf and downloaded to the ward terminal or the client device that is used to display the ward terminal's GUI.
When clicking on ***Download as CSV***, the currently displayed table is converted to a simple ASCII-text file with columns separated by commas (see Fig. 63) and downloaded to the ward terminal or the client. Files of this type can be read in by a text editor but also by common spreadsheet applications like Excel, for instance such that analyses can be easily exported.
This exporting function can be used to simplify the documentation process in the care facility as all relevant data is collected and presented in a compatible format automatically.

```
SensFloor Activity Report,c0a00146
Alarms,All
22.11.2020,20.12.2020
06:00,21:00
Tue Sat Sun
total,15
number,type,start time,end time,x,y
0,fall,22.11.2020 13:13:08,22.11.2020 13:18:41,0.668,0.332
0,fall,22.11.2020 13:30:18,22.11.2020 13:35:35,0.682,0.620
0,fall,22.11.2020 13:35:41,22.11.2020 13:35:41,3.821,0.367
0,fall,22.11.2020 13:35:46,22.11.2020 13:35:54,4.846,0.690
0,fall,22.11.2020 14:03:43,22.11.2020 14:04:59,2.706,0.133
0,fall,22.11.2020 14:06:00,22.11.2020 14:10:48,1.454,0.251
0,fall,01.12.2020 12:31:39,01.12.2020 12:31:42,3.856,0.916
0,fall,05.12.2020 09:02:32,05.12.2020 09:07:25,0.934,1.006
0,fall,05.12.2020 09:22:42,05.12.2020 09:28:43,1.467,1.695
0,fall,05.12.2020 09:52:49,05.12.2020 10:00:15,5.465,0.931
0,fall,12.12.2020 08:53:04,12.12.2020 08:56:15,1.533,1.682
0,fall,12.12.2020 08:56:41,12.12.2020 09:02:56,0.627,0.230
0,fall,19.12.2020 10:44:42,19.12.2020 10:49:35,0.678,0.220
0,fall,19.12.2020 11:11:52,19.12.2020 11:12:06,4.212,0.881
0,fall,19.12.2020 11:14:15,19.12.2020 11:21:57,0.513,0.311
```

Fig. 63: CSV-formatted text file.

4.4 System: Configuring system parameters of the SE10

By means of the ***System App*** accessible through the port 7777 http://192.168.5.5:7777 basic information about the system such as OS name and version, free disk space and temperature can be obtained. The accessibility of the device for remote maintenance can also be changed here. In addition, ID, type, frequency, and firmware version of the transceiver board is displayed. Under ***Time***, the real-time clock can be set or be synchronized with an NTP clock on the internet.

In the ***Software*** panel, the activation ***State***, which can be changed using the button, version, and uptime of each SensFloor app is indicated. ***Show*** controls whether this app is displayed on a monitor connected to HDMI of the SE10 room terminal.

The interface language can be changed using the flags in the footer.

Using the "**Change View**" field in the footer additional Information pertaining the **network** configuration can be shown by selecting the "**advanced**" option. This does not allow changes to be made to the network parameters. For safety reasons the url has to be changed to http://192.168.5.5:7777?expert to unlock the "**expert**" view option which subsequently allows the modification of all parameters. The background of the expert view is colour tinted to notify the user of the possibility for critical changes. Furthermore the view will reset to "advanced" 5 minutes after activating the expert mode.

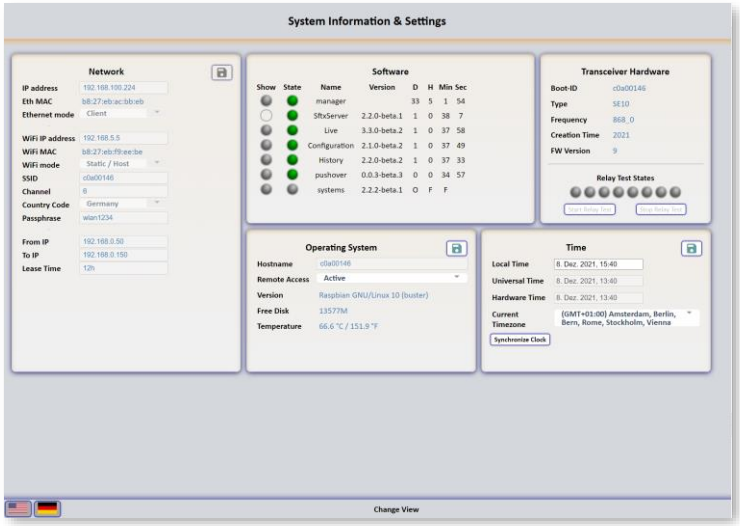


Fig. 64: Obtaining and changing system parameters.

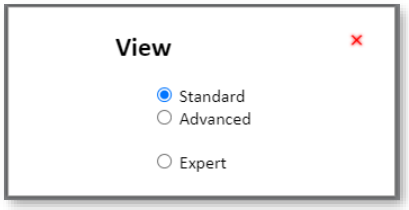


Fig. 65: Changing the View Level. Expert requires correct URL.

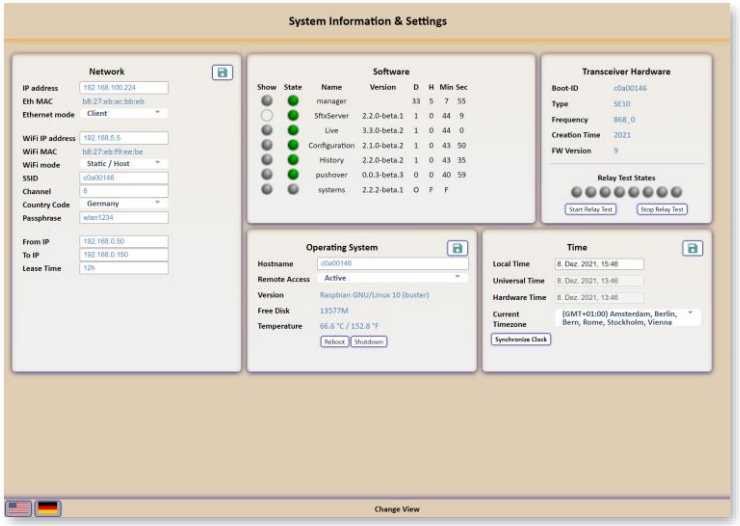


Fig. 66: Expert view with tinted background.

As changing these parameters in the wrong way can render the SE10 inoperable, this app should be used by expert service personnel only!

4.5 SensFloor LIFE and the Pushover app

If the room terminal is connected to the internet, is possible to send alarms as pushover messages to smartphones. This function, which is part of the new ***SensFloor LIFE*** system, makes use of the *Pushover* cloud service which charges a monthly fee for each new end user. End users can be registered in the *Pushover for Teams* account on https://pushover.net. Each teams-account is associated with a so-called ***Pushover token***. In the teams account, a new end user can be applied for by entering a name and an email address. At the end of this process, a new chargeable ***Pushover user*** ID is generated and an email with a link to the mobile *Pushover* app is being sent to the new end user's email address. By means of this link, the end-user can download and install the mobile *Pushover* app on one or more of his/her personal mobile devices.

To receive push-messages, the end-user's data must be entered in the ***SensFloor LIFE*** app which is accessible through the port 3000: http://192.168.5.5:3000 on the room terminal (see Fig. 67).
This ***User configuration*** is visible after tapping ***User*** in the options menu ☰.
As a default, the ***Pushover token*** of the manufacturer's *Pushover for Teams* account is already filled in. The App makes use of the ***SensFloor Care API*** that is described later in this manual. The green bar at the bottom shows a successful connection to this API.

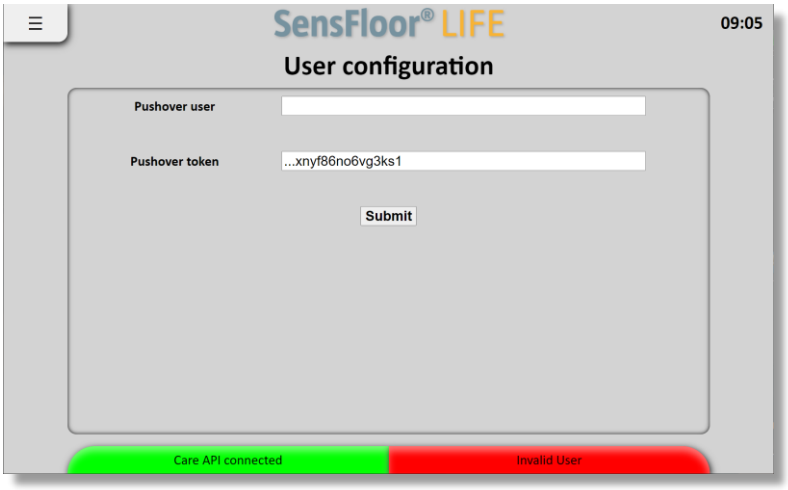


Fig. 67: Initial view of the SensFloor LIFE App

The red bar shows that no valid user is registered so far. After entering the ***Pushover user*** ID and pressing ***Submit,*** the green banners indicate a successful link between the ***SensFloor LIFE*** app and the end user.

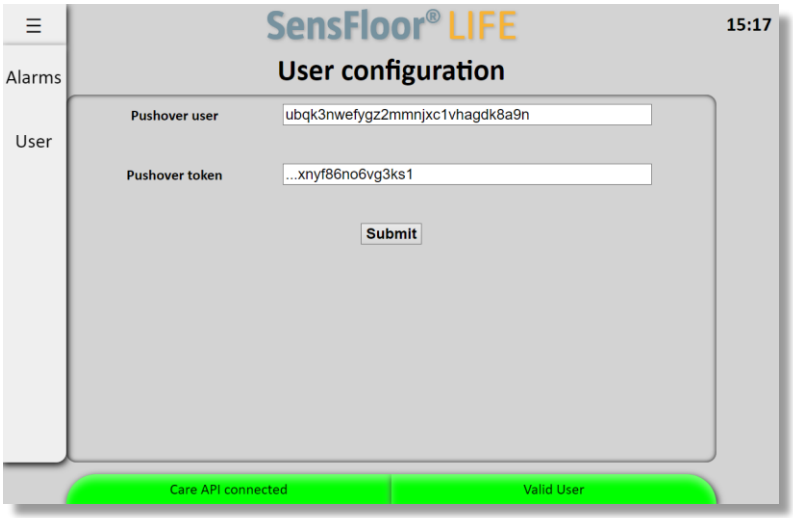


Fig. 68: SensFloor LIFE App to configure push messages to mobile phones.

The next step is the configuration of the push messages by tapping ***Alarms***. When the end user has used the link in his email to register multiple mobile devices, it is possible to configure the settings for each device separately by selecting the device from the dropdown list in the title (in Fig. 69 the device is named *Basic*).
Each of the alarms configured in the room terminal can be selected as trigger for a push message by ticking ***Active*** and defining a period in which the message should be sent.
The ***Priority*** for the alarm can be chosen from ***Emergency, High, Normal*** and ***Low***.

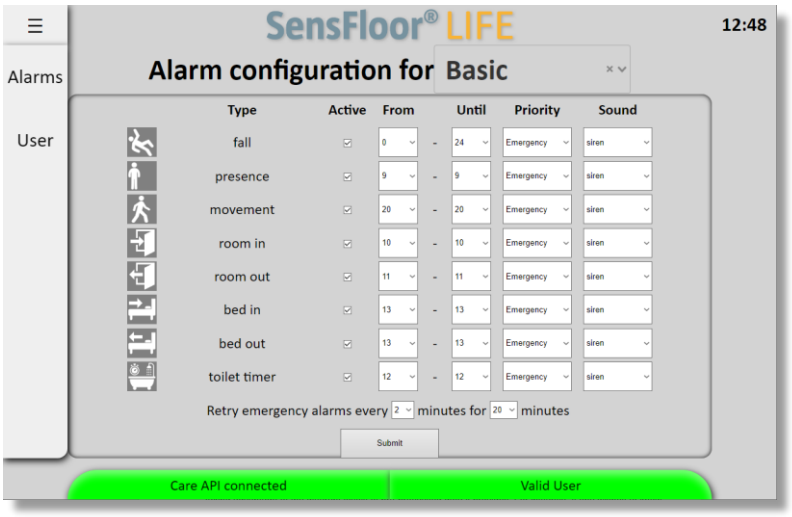


Fig. 69: Configuring the push messages.

Emergency: These messages are high priority messages that bypass a user's quiet hours. These messages will always play a sound and vibrate (if the user's device is configured to) regardless of the delivery time. Emergency-priority should only be used when necessary and appropriate e.g., for emergencies like a fall.

High: These messages trigger sound, vibration, and display an alert according to the user's device settings. On iOS, the message will display at the top of the screen or as a modal dialog, as well as in the notification center. On Android, the message will scroll at the top of the screen and appear in the notification center.

Normal: These messages will not generate any sound or vibration but will still generate a popup/scrolling notification depending on the client operating system. Messages delivered during a user's quiet hours are sent as though they had normal priority.

Low: These messages will not generate any notification but will be visible in the *Pushover* app's message list.

For each Alarm, a separate sound can be selected from a long list. This sound will be played on the mobile device when the push message arrives, given the user's sound settings allow so.

It is important that emergency messages are recognized and acknowledged by the end user. Therefore, it is possible to define a frequency and duration for their repetition until acknowledgement using the settings in ***Retry emergency alarms*** (see Fig. 69).

It should be noted that changing these configurations is only possible by means of the ***SensFloor LIFE*** app on the room terminal and not from the end user's mobile device.

Depending on the mobile device's brand and settings, the push messages may look differently on the end user's phone. However, an ***Emergency*** alarm will always show as a popup window that must be acknowledged by tapping ***ACKNOWLEDGE*** (see Fig. 70 left).
When tapping on the message itself, the *Pushover* app opens and shows the complete list of all messages of the last 24 hours (see Fig. 70 right). In this list, not yet acknowledged messages appear in red. The other messages show in colors that are associated with their priority.
Of course, the *Pushover* app can be opened at any time directly. In this app, several *Pushover*-specific settings can be configured, such as the quiet hours or the appearance of the app's GUI. Refer to the service's website https://pushover.net to learn more about these settings.

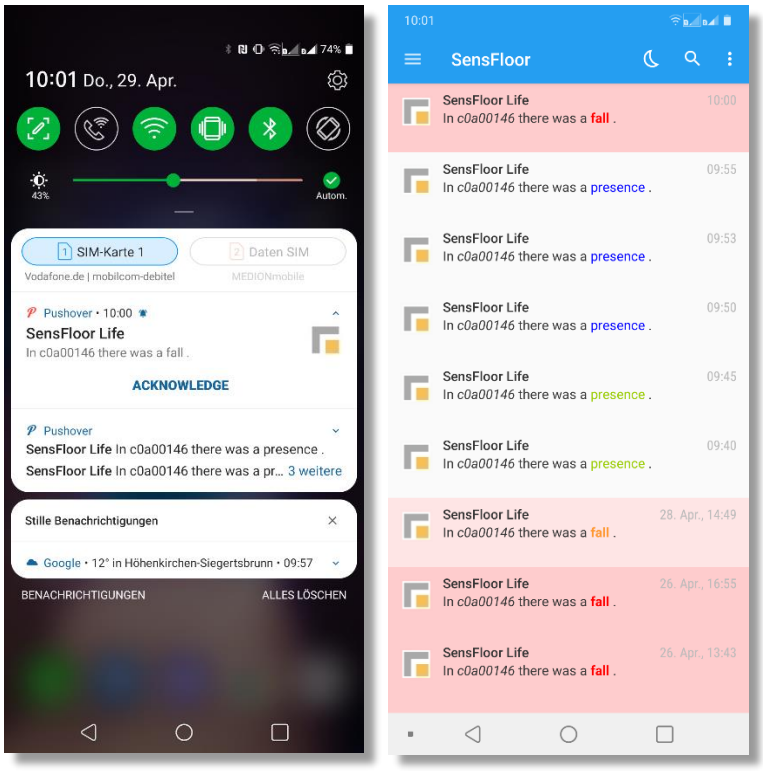


Fig. 70: SensFloor LIFE on the mobile device: Popup of an emergency message (left) and list of messages in the *Pushover* app (right).

4.6 The Manager App: Updating and licensing apps

4.6.1 Online updates

All apps described in this manual are continuously improved by the developers. From time-to-time new versions with bugfixes or new features are released by the manufacturer. To see the current version numbers and to check whether a new update is available, the ***Manager*** app can be accessed through port 15000 of the device. Fig. 71 shows the interface. All currently installed apps are listed with their ***Version*** number and their ***Expiration Date***. Usually, the customer has obtained an unlimited license to use the set of apps that was delivered together with the hardware. However, in special cases, such as feature tests, the usage time may be limited. In this case the app will stop working when the ***Expiration Date*** is reached.

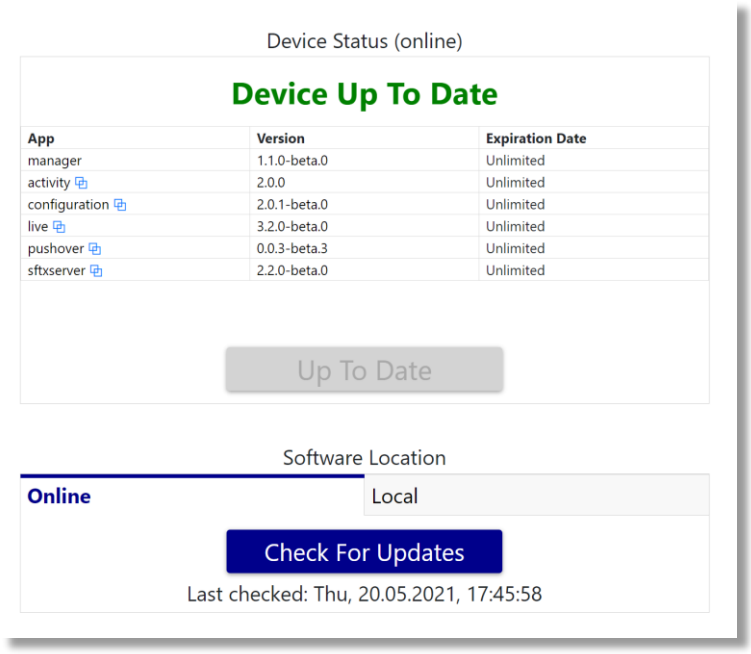


Fig. 71: The Manager app shows the current versions of the installed apps

If the user has forgotten, which names are associated with which visualization, it is possible to jump right to the corresponding GUI by tapping the ⧉ symbol right of an app's name. By clicking on ***Check For Updates***, the application searches for a new license file on the cloud server. This license file contains information about which versions of the apps are licensed for which device. The license file can be edited by the manufacturer only. If there exists a new license file, the ***Manager*** app downloads, decrypts, and parses the file. If it finds new licensed versions of one or more apps, it offers to download these apps from the cloud server and installs and starts them automatically when tapping ***Update Now*** (see Fig. 72). In the list of apps, the old and new version is indicated.

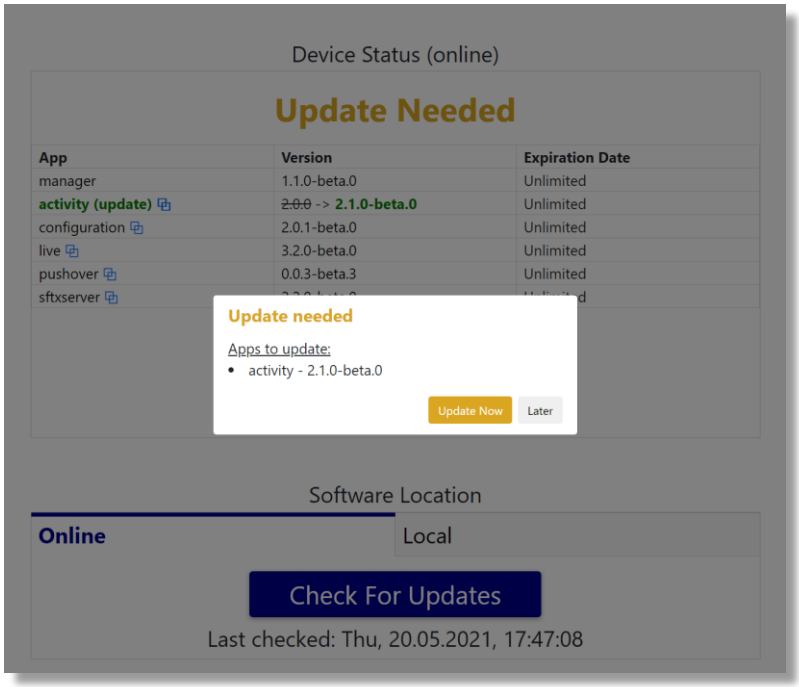


Fig 72: One app is available in a new version.

4.6.2 Updates by the manufacturer/distributor

This form of update requires that the corresponding device has free access to the internet to check the cloud server for updates. If the client network allows for secure access to the devices from external networks (e.g., through VPN or a tunnel), this update can also be done remotely either by the distributor or, exceptionally, by the manufacturer through its IoT maintenance access tunnel.

4.6.3 Automatic updates

If the device is qualified for automatic updates by a corresponding flag in the license file, the whole process runs automatically if the device remains connected to the internet and has access to the cloud server.

It is important to note, however, that during the update process the device is not functional in the SensFloor Care system. Another important issue to consider is the necessity to observe and test whether an update works properly in a specific customer installation (see section *After Updating*). This testing period is also required when apps have updated automatically.

4.6.4 Offline on-site updates

To update devices which have no internet connection, another update method is available. The manufacturer can generate a software bundle containing an encrypted updated license file and the corresponding compiled versions of all licensed SensFloor Care apps. This bundle is transferred to the customer/distributor by e-mail or a cloud service (Dropbox, OneDrive etc.). The customer's/distributor's service personnel can connect to the device through LAN/WiFi and use the device's ***Manager*** app to upload and install the software on-site. In the app, ***Local*** must be selected as ***Software Location***.

Fig. 73 shows the process step by step. After clicking ***Upload Software***, a zip-file with the bundled software can be uploaded from the client to the device. If the contained license file contains licenses for newer versions than the ones already installed, the ***Manager*** app offers to install these versions from the bundle. The process finishes by automatically restarting the new apps.

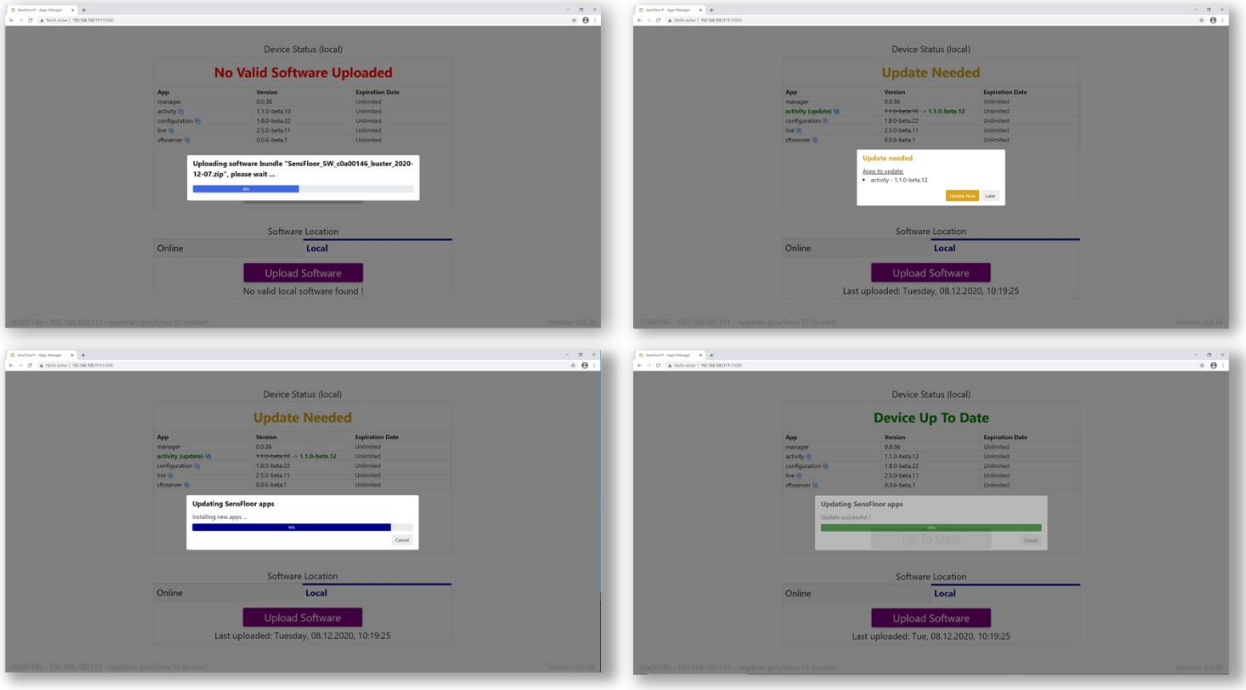


Fig. 73: Process for locally updating from a software bundle (zip-file).

If at any point in the offline or online update process an error occurs, e.g., the upload of the bundle or the download of the new versions from the cloud server fails, the manager invokes its roll-back function and restores the previous versions of the apps. In that case, the update process can be repeated afterwards.

4.6.5 After updating

Most updates come with new features and functions. The manufacturer will provide training material and manuals so that the customers can profit from these new properties.

All apps which are not marked as beta versions have been tested by the manufacturer. However, there is always a possibility for undesired behavior in individual SensFloor installations. Therefore, it is mandatory to observe and test an updated installation for a certain time after the installation. Customers should collect information about problems or malfunctions and transmit that information to the manufacturer. An existing valid software maintenance contract covers rectifying bugs and malfunctions of the apps. Please note that it is possible that new app versions are not compatible with previous configurations such as alarms or layouts. In those cases, it is required to repeat the configuration as described in the corresponding sections of this manual.

In general, feedback from the customers and end users is a valuable source of information to improve the apps and to add new features in the future.

4.7 Station: Aggregating information from many room terminals

A standard SensFloor installation in the domain of health care comprises several apartments each of which is equipped with its individual room terminal. The activity information from several room terminals is transmitted via LAN to a ward- or station terminal, which collects the information and displays the status of the rooms in an aggregated view either on a fixed monitor or on the web browser of a mobile device. Refer to the manual " E_Manual_Ward_Terminal", which is available from Future-Shape, for a detailed description.

In some situations, however, it may be advantageous to display the status of a room in the same way as on a ward terminal although the installation consists of one apartment only. This may be the case, for instance, if the status of a private apartment should be visible to a relative living somewhere else. In that case, the ward terminal software can be integrated as app into the single room terminal and the distant person can access this app through a VPN over the internet as described in section 3.3.

If the optional ***Station*** app is part of the SE10, it is accessible through port 10000: http://192.168.5.5:10000. The image on the right shows a typical display with a ***Fall***-alarm symbol on the upper left and a time stamp for the last activity in Room1 on the upper right. Alarms can be acknowledged by tapping on the alarm symbol The ***Live*** and ***Activity*** apps from section 4.2 and 4.3 are accessible by tapping the room's name on the lower left and the statistics icon on the lower right.

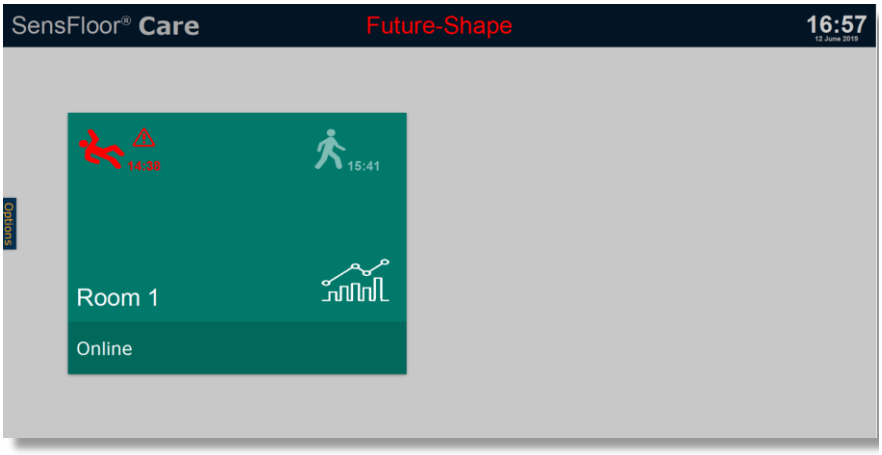


Fig. 74: Station app for one room.

Current alarms are indicated by coloring the room's tile in the corresponding colors introduced in section 4.1.5. After current alarms have been acknowledged, they are added to a list of grey symbols in the upper left corner. Tapping on such a past alarm leads directly to the replay function of the history app (refer to the manual of the ward terminal) so that the corresponding event can be analyzed in detail.

Current activity is indicated by a blue color and an activity indicator for every person in the room. The SensFloor can be temporarily deactivated and recalibrated by tapping on the bar below the room's name. Please refer to the manual "E_Manual_Ward_Terminal" for a more detailed description.

4.8 API: Obtaining SensFloor raw data and events from a terminal

To extract information about events or the position of objects from a room terminal, an API (*application programming interface*) is available. The SensFloor API allows a developer to build his/her own application by taking advantage of the different levels of pre-processed data it provides. For instance, if one wishes to know whether there is any activity on the floor at all or wants to count the number of persons in the area or take an action when a fall is detected, the API can be used to obtain this information.

The API is reachable via web sockets, namely via socket.io (see https://socket.io/). To use to the API, the IP address of the SE10 must be known (see section 2.3 of this manual). In case the access runs through Wi-Fi, the URL is http://192.168.5.5:8000.

A detailed description of the data format and code examples are contained in the manual "SE10 API" that can be obtained from Future-Shape.

The optional ***Station*** app has its own API by means of which data from many different room terminals can be extracted. Information about this API is contained in the document „E_SensFlor_Care_API“, that is available from Future-Shape.

5 Additional information

5.1 Disclaimers and warnings

Disclaimers

- The SensFloor Care system is an assistance system that does not replace any human surveillance and care.
- The end user must be aware, that there exist situations in which (1) the SensFloor Care system cannot detect a fall and (2) in which a fall alarm is given even though no fall has occurred.
- The SensFloor system provides not a signal denoting any medical emergency, and the distributor or supplier is not required to contact or dispatch any medical emergency or assistance.
- The SensFloor system must be installed by a certified expert in the room that is intended to be monitored.
- The SensFloor system is for indoor use only.
- The SensFloor underlay may not be installed in the shower.
- To forward alarms to the emergency contact, the ward terminal must be permanently observed and/or the SensFloor Care system must be paired to an existing indoor call system and/or to the SensFloor LIFE push message service.
- The size of a room which can be supported by one SensFloor transceiver SE10 is limited by the wireless transmission range of approx. 20 meters (free field).
- The SensFloor underlay may not function properly if it is (1) installed beneath not certified flooring or (2) with not certified adhesives on top of the SensFloor underlay, (3) cleaned with liquids that leave a conductive layer on top of the flooring, (4) during wet cleaning as long as the floor is not dry again, (5) in environments with high air moisture, or (6) when detecting falls of people wearing thick clothing.
- Presence of pets or additional people in the room during a fall might cancel/prevent the fall detection.
- An accumulation of people in the room, pets, water puddles, electrical cables/devices, wet or conductive materials on the floor can trigger false fall alarms or activity notifications.
- The SensFloor System detects falls on areas only, where the SensFloor underlay is installed.
- When testing the system, it is recommended to repeat the test in different locations around the room to make sure the system covers all accessible areas of the room.
- A fall test should be repeated once a month to make sure the system is still functioning correctly.

Warnings

- The device will not function during a power outage.
- The device will not transmit an alert to an emergency contact if the LAN/WLAN is not working or the indoor call system is down or defective.
- Installation and use instructions must be followed precisely, or the system will not work.

5.2 Safety information

Never open or disassemble any of the devices belonging to the SensFloor® Care system! Do not open any distribution boxes or electrical cable installations! Do not drill any screws into the floor that is equipped with the SensFloor system! Do not open the floor covering! If moisture has entered the floor construction, switch off the power supply immediately!

Investigate any alarm messages immediately! Do not acknowledge any alarm message without checking the cause! A seemingly false fall alarm may be due to moisture on the floor which must be removed to reduce the risk of falling. After switching off the system (e.g., for cleaning) ensure its reactivation!

5.3 Troubleshooting and Frequently Asked Questions

Observation	Cause	Measure
Live view or timeline show activity for periods when the room was empty.	Sensors measure spurious changes in capacity.	Check location in the room for objects/cables/dirt/moisture on the floor. Remove cables and metallic objects. Clean floor with pure water and wait until it has dried out. Recalibrate the floor by means of the taskbar.
When cleaning the floor, false fall alarms occur.	Floor sensors are activated by moisture.	During cleaning, switch off the room's SensFloor® by means of the taskbar. Wait until floor is dry and switch on again.
Fall alarms occur when multiple people are in the room.	The fall detection algorithm evaluates the size of the active area.	Call service who can reduce the sensitivity of the floor sensors.
Pets in the room activate the sensors or cause false alarms.	System cannot distinguish between animals and humans.	Deactivate the SensFloor® at times when pets are in the room.
Events do not lead to the desired alarms.	Wrong alarm configuration.	Check whether the desired alarms have been configured for that room and the active time is set correctly (see Fig. 4). Call service to change the base configuration of that room.
Alarms are shown but there is no alarm sound.	Alarm sound is switched off in the alarms' configuration (see Fig. 3). The monitor's or client's sound is switched off.	Activate the sound by means of the options panel in the room overview. Check the sound configuration of the monitor or client.
Alarms show in the ward/room terminal but not in a connected indoor call system	There is a problem in the connection to the indoor call system	Call service of the manufacturer of the indoor call system.
Single sensor fields show permanent activity.	Sensor fields may be broken.	Refer to section 4.1 to switch off those fields. The overall function is not impaired.
The room terminal's GUI works not as intended (does not react, shows service windows, or is distorted)	The Raspberry Pi that the room terminal apps run on has a software- or hardware problem.	Restart the room terminal by disconnecting the power supply for some seconds. Call service if the problem persists.
The monitor of the ward/room terminal shows no image.	The power supply to monitor or terminal is interrupted. The monitor is switched off. The HDMI-cable is broken or not connected.	Ensure that the physical setup is correct (refer to section 3).
The tiles of one or more rooms show the message "Floor off" on the ward terminal.	The SE10 in the room does not receive any radio messages from the SensFloor® underlay.	Switch on the SensFloor® by means of the key switch in the room or the switch in the room's electrical installation box. Call service if the problem persists.
The tiles of one or more rooms are missing or show the message "Disconnected" on the ward terminal.	The network connection between the room and the ward terminal does not work.	Ensure that the network cables of the SE10s and the ward terminal are connected. Ask your local network administrator for help.

In live view, large areas of the floor are permanently active although the floor is dry.	Moisture may have entered the floor construction.	Switch off the power supply to the SensFloor® in the room to avoid a short circuit and call service.

5.4 Service address

For questions or requests, please contact our distributor who has installed your SensFloor® Care system. Depending on your service and maintenance contract, you may also contact the manufacturer's support:

Future-Shape GmbH, Altlaufstrasse 34, 85635 Hoehenkirchen-Siegertsbrunn, Germany

Tel.: +49 8102 89638 , E-mail: support@future-shape.com, Web: http://www.future-shape.com/

5.5 Cleaning-, recycling- and certification-information

The hardware of the SensFloor Care system consists of various components. Cleaning, recycling, and conformity information of each component can be found in the corresponding manuals and datasheets that have been delivered together with the system at hand over of your SensFloor® Care installation. In addition, the datasheets of those components that are manufactured by Future-Shape GmbH can be requested by using the service address. The declaration of conformity of the system components that are manufactured by Future-Shape can be found at the end of this manual.

5.6 Warranty

The conditions for warranty are listed in the General Terms and Conditions of the manufacturer.

5.7 References

The following documents are to be considered as part of the manual and can be obtained from the manufacturer by making use of the service address.

E_SensFloor_Installation_Manual
E_Manual_Ward_Terminal
E_Manual_SensFloor_System
E_SE10_API
E_SensFloor_Care_API

6 Abbreviations and glossary

6.1 Abbreviations

GUI = graphical user interface
LAN = local area network
USB = universal serial bus
FAQ = frequently asked questions
PC = personal computer
RTC = real time clock
IP = Internet protocol
SE10 = room terminal
VPN = virtual private network
API = application programing interface

6.2 Glossary

Words in **bold face** refer to Text in the graphical user interfaces.

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7 Declaration of conformity

As part of our due diligence, we pay attention to the certification of manufacturers of components and semi-finished products in our supply chain. This applies to ingredients and their origin from countries of origin not classified as critical (EU)2017/821.

Future-Shape GmbH, Altlaufstr. 10, 85635 Höhenkirchen - Siegertsbrunn, Germany
declares with the CЄ mark, that the SensFloor® system meets the basic requirements and guidelines of the European regulations in combination with top flooring that is CЄ-certified and approved by Future-Shape.

Underlying EU regulations and standards

REACh (EU) 1907/2006; Registration, Evaluation, Authorisation and Restriction of Chemicals
RoHS 2011/65/EU; restriction of the use of certain hazardous substances in electrical and electronic equipment
DIN EN IEC 63000;VDE 0042-12: Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances
RED 2014/53/EU; provision of radio equipment / EMC 2014/30/EU; Electromagnetic compatibility
DIN EN 60601-1:2013-12;VDE 0750-1:2013-12: Medical electrical equipment - Part 1: General requirements for basic safety and essential performance; EN 62479:2011-09;VDE 0848-479:2011-09: Assessment of the compliance of low power electronic and electrical equipment with the basic restrictions related to human exposure to electromagnetic fields; DIN EN 300220-1, V3.1.1: Short Range Devices (SRD) operating in the frequency range 25 MHz to 1000 MHz - Part 1: Technical characteristics and methods of measurement; DIN EN 300220-2, V3.1.1Short Range Devices (SRD) operating in the frequency range 25 MHz to 1 000 MHz - Part 2: Harmonized standard for access to radio spectrum for nonspecific radio equipment
CE-Conformity on the basis of hEN 14041: Resilient, textile, laminate, and modular multilayer floor coverings - Essential characteristics; EN 13501-1 Fire classification of construction products and building elements ; ISO/TR 11925-1: Reaction to fire tests - Ignitability of building products subjected to direct impingement of flame ; EN 12667:2001-05: Thermal performance of building materials and products - Determination of thermal resistance; DIN EN ISO 24343-1:2012-04: Resilient and laminate floor coverings - Determination of indentation and residual indentation; DIN EN 1991: Eurocode 1: Actions on structures; EN 16516:2020-10 Construction products: Assessment of release of dangerous substances - Determination of emissions into indoor air.