Make Alarm Configuration easy.

07

Final design

This chapter presents the final design: SetWise. Initially, an overview of the final design is provided, followed by a detailed walkthrough of each interface screen, including the key features. The chapter concludes with an explanation of how SetWise fits into the broader system architecture, including an explanation of the underlying algorithms.

7.1 The Design: SetWise
7.2 System architecture

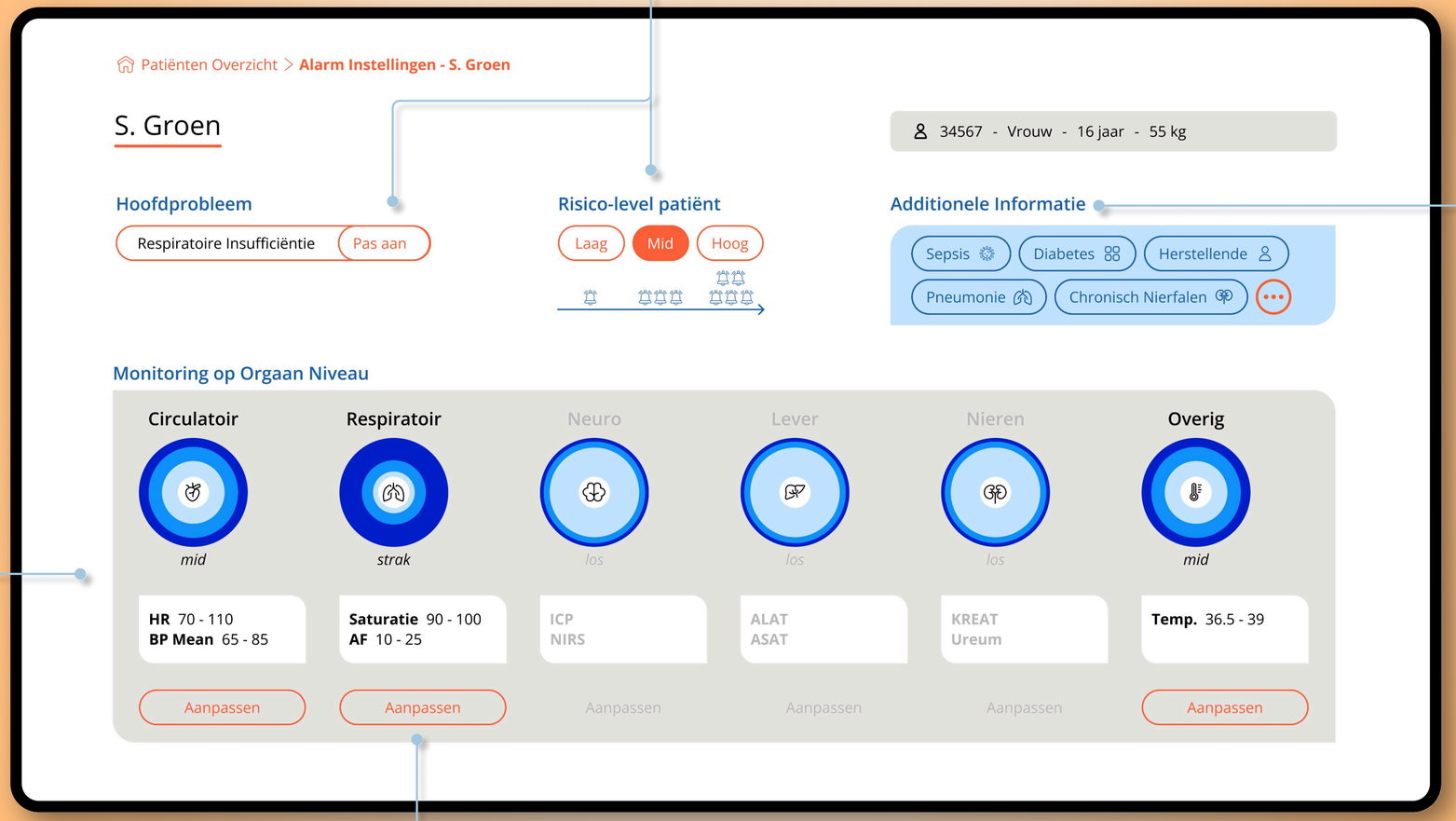
Final Design

SetWise

SetWise is a **configuration interface** designed to support nurses in creating a personalised set of alarm rules for each patient, intending to reduce the overall alarm load in the ICU. While simplifying the configuration process, SetWise generates alarms that are both clinically relevant and context-aware. The interface acts as input for multiple algorithms to create the personalised alarm rules. SetWise is located next to the patient bed and can also be accessed from computers at the central nurse station.

[Click here to interact]

Two-Step Configuration
SetWise simplifies the setup process by guiding nurses through just two essential steps. Select the patient's primary clinical problem and risk level, and the system automatically configures detailed monitoring settings.



Clear overview
SetWise provides a comprehensive overview of the configured monitoring settings across all organ systems. This layout enables nurses to quickly verify or adjust settings without losing sight of the bigger clinical picture.

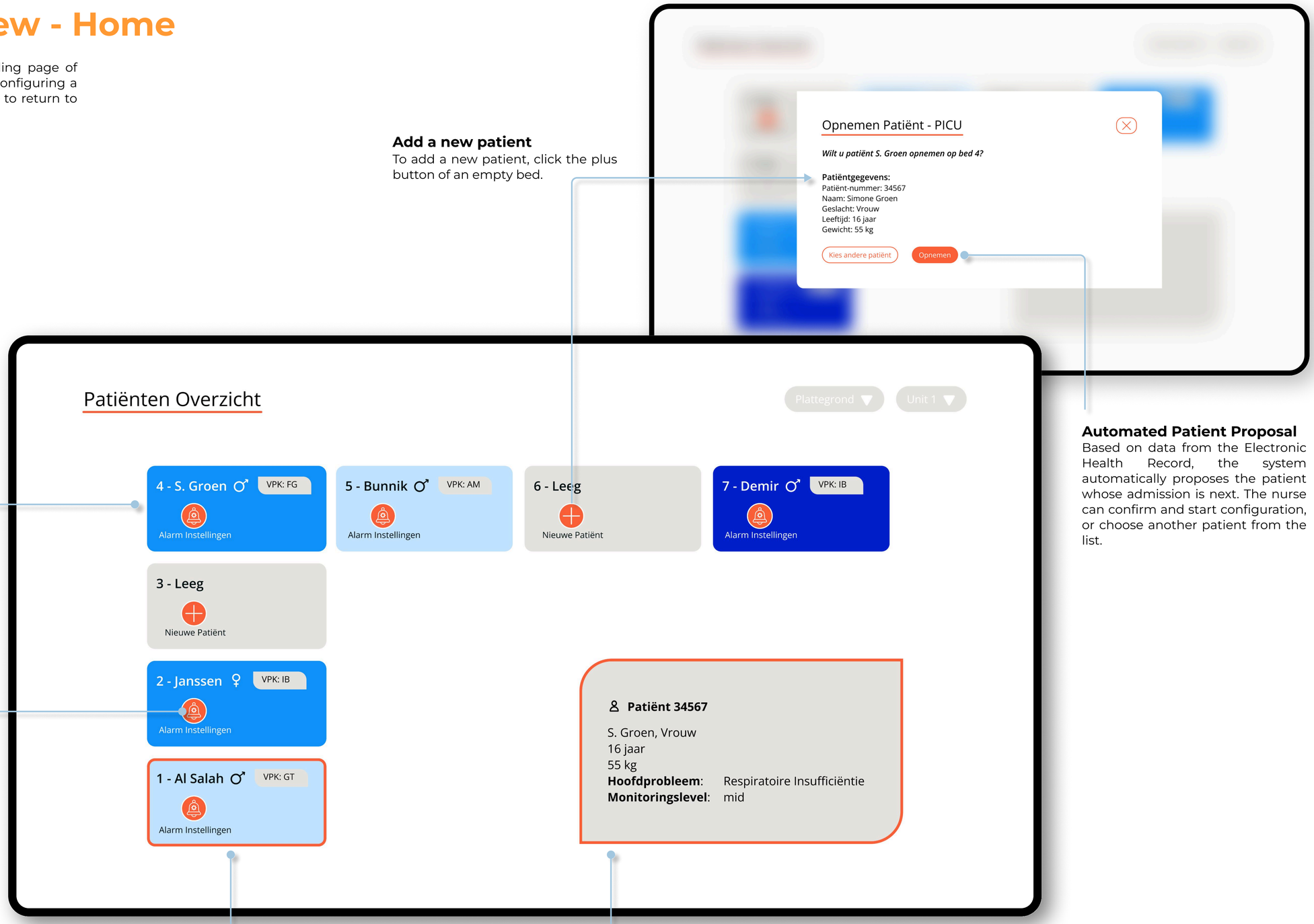
Context-Aware Shortcuts
Use the predefined additional information labels to add contextual details about the patient easily. These inputs further refine the configuration of target ranges and detailed monitoring levels, ensuring that the alarm settings accurately reflect the patient's current situation.

Dive deep, if desired
The proposed detailed monitoring settings can always be fine-tuned.

Patient Overview - Home

The patient overview serves as the landing page of the interface. It is the starting point for configuring a new patient, and acts as the home page to return to for an overview of all patients in the unit.

Add a new patient
To add a new patient, click the plus button of an empty bed.



Keep Overview
The home page enables an overview of all patients and their configured risk level, indicated by the colour of the beds.

- High Risk Level
- Mid Risk Level
- Low Risk Level

Automated Patient Proposal
Based on data from the Electronic Health Record, the system automatically proposes the patient whose admission is next. The nurse can confirm and start configuration, or choose another patient from the list.

Patient Specific Settings
Easily navigate to the alarm settings of a specific patient by clicking the 'Alarm Settings' button.

Patient information
View detailed patient information by clicking on the patient bed. This contextual information helps nurses make informed decisions about configuration.

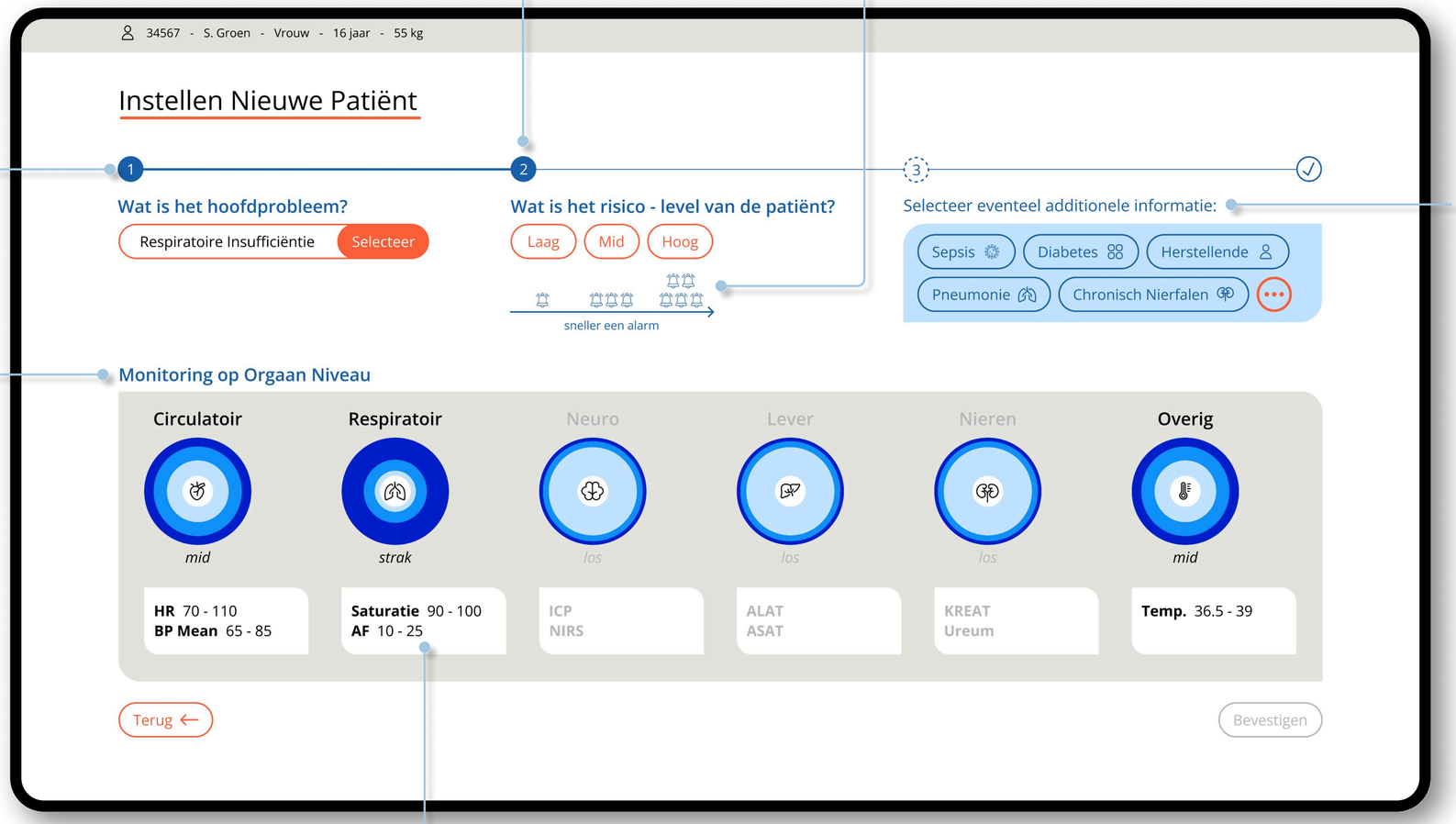
Configure a New Patient

New patients are configured in just two mandatory steps. As the user progresses through the configuration, the detailed organ-system monitoring settings adjust in real-time, allowing for immediate insight into the **implications** of **each configuration choice**.

Step-by-step Guidance
The progress bar guides the user step-by-step through the configuration process.

The Higher the Risk, the More Alarms
The second step is to assign a risk level to the patient. This classification is used by the system's underlying algorithms to determine the sensitivity and frequency of alarm triggers.

The main problem
The first step is to select the patient's main clinical problem, which reflects the **main** reason for admission. This can always be updated in the general alarm settings overview if the patient's condition changes during the ICU stay.



Real-Time Adjustment
Once the main problem and risk level are selected, the system automatically adjusts the monitoring levels and corresponding target ranges for each organ system in real-time.

Additional information
ICU patients can have complex pathologies and medical backgrounds. Nurses can further refine the configuration by selecting additional clinical information labels, and the detailed monitoring will automatically adjust.

Target Ranges
Each parameter displays a target range, which represents the values considered "normal" for a specific patient's condition, based on the main problem, additional information, and patient details.

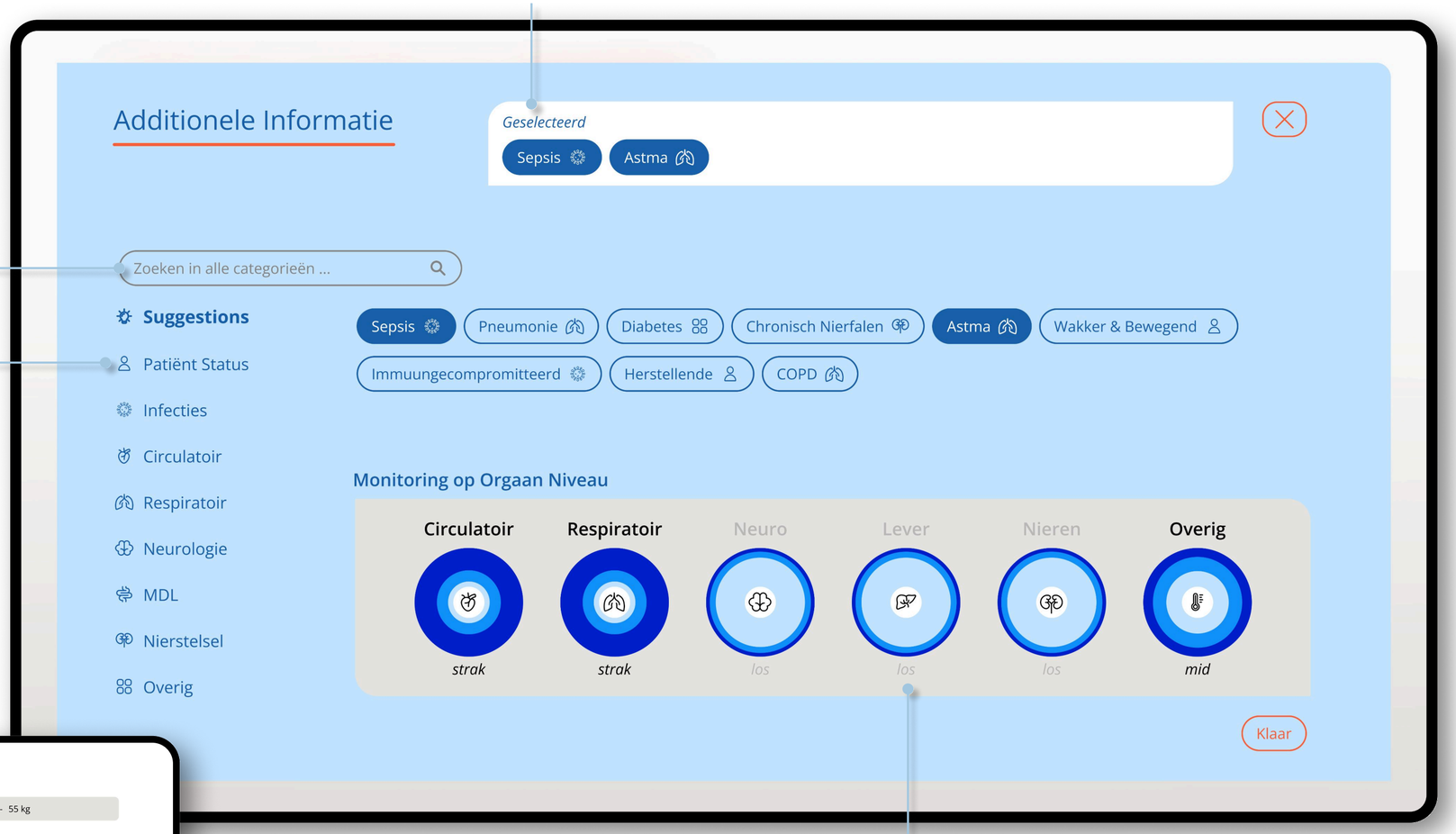
Additional Information Labels

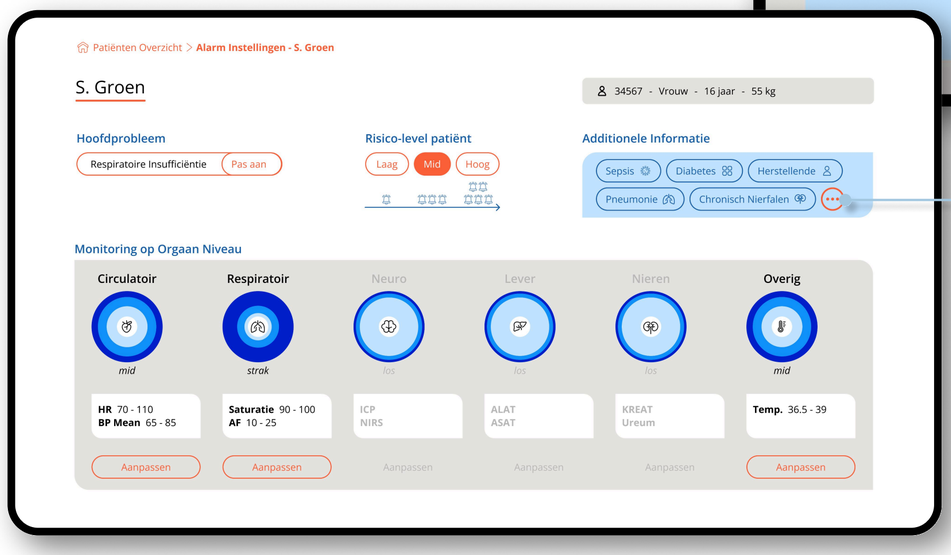
After a new patient is configured, the user is redirected to the patient overview screen. From there, the alarm settings can be accessed and refined, such as the Additional Information Labels. These features enable users to add detailed clinical information, allowing for more precise configuration of individual patients.

Selection on top
Selected labels are shown at the top of the screen, offering a clear overview of all applied labels.

Search all
Search across all categories using the general search bar.

Filter on organ system
The categories help to find the right information.





Suggested Labels
Because the database of available labels is extensive, the interface shows only a limited set of suggestions based on the selected clinical problem and patient background. Users can expand this list by opening the pop-up.

Real-time Feedback
As additional labels are added, the system updates the monitoring levels and target ranges immediately to show the impact of each label.

Circulatory Settings

By going one level deeper into the settings, users can adjust the target ranges of vital parameters for the circulatory organ system.

Never out of sight
The patient's information remains visible at the top of the screen to ensure that changes are always made for the right patient.

Fine Tune Organ Monitoring
Although the system initially determines the monitoring level based on the patient's overall risk and clinical context, nurses can still manually adjust this level (loose, mid, or tight). These levels determine the system's sensitivity to deviations in vital parameters, which is visualised by the real-time adjustment of the target range graphs.

Tailored Additional Information
Only relevant additional information labels that affect circulatory monitoring are shown.

Next Organ System
Directly navigate to the other organ-systems.

Loose

15 seconds

Mid

10 seconds

Tight

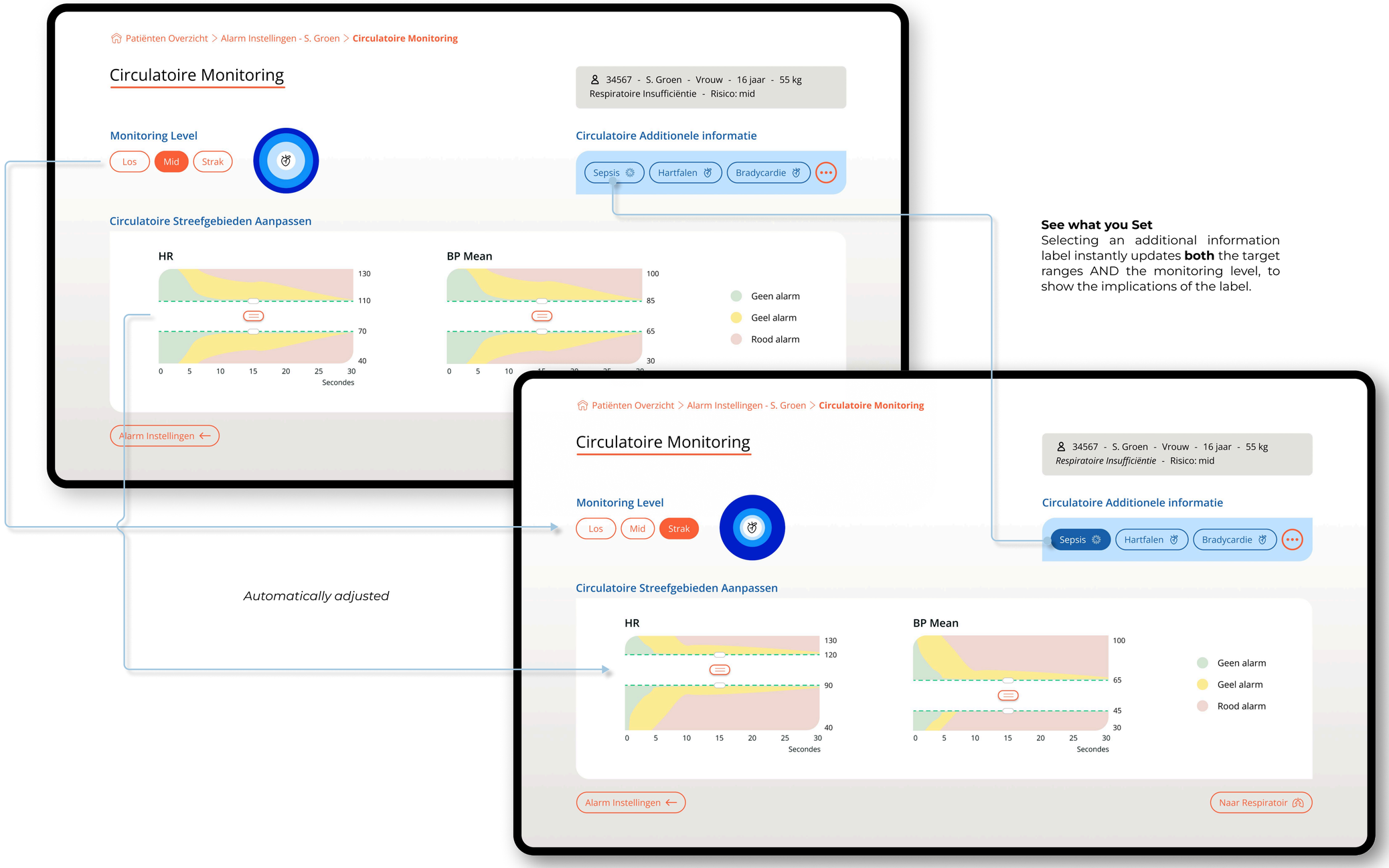
5 seconds

Target Range Graphs
The graphs show how long it takes before a vital parameter exceedance will trigger an alarm. For example, if the monitoring level is set to loose, a small deviation will trigger an alarm after approximately 15 seconds. **Note**: if the deviation is large, the alarm may be triggered sooner.

No alarm, within safe renge

Medium priority alarm

Critical Alarm

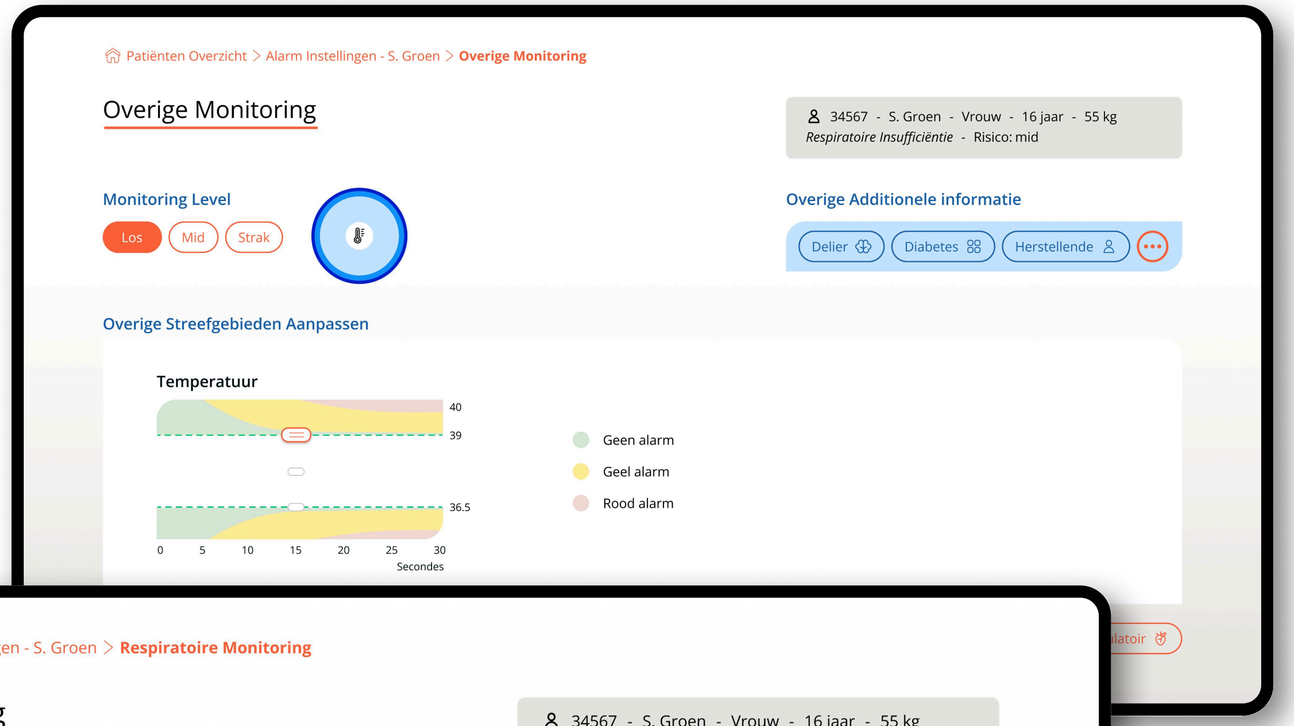


See what you Set
Selecting an additional information label instantly updates **both** the target ranges AND the monitoring level, to show the implications of the label.

Respiratory & Other Settings

The Respiratory and Other settings follow the same structure as the circulatory settings to ensure a streamlined experience.

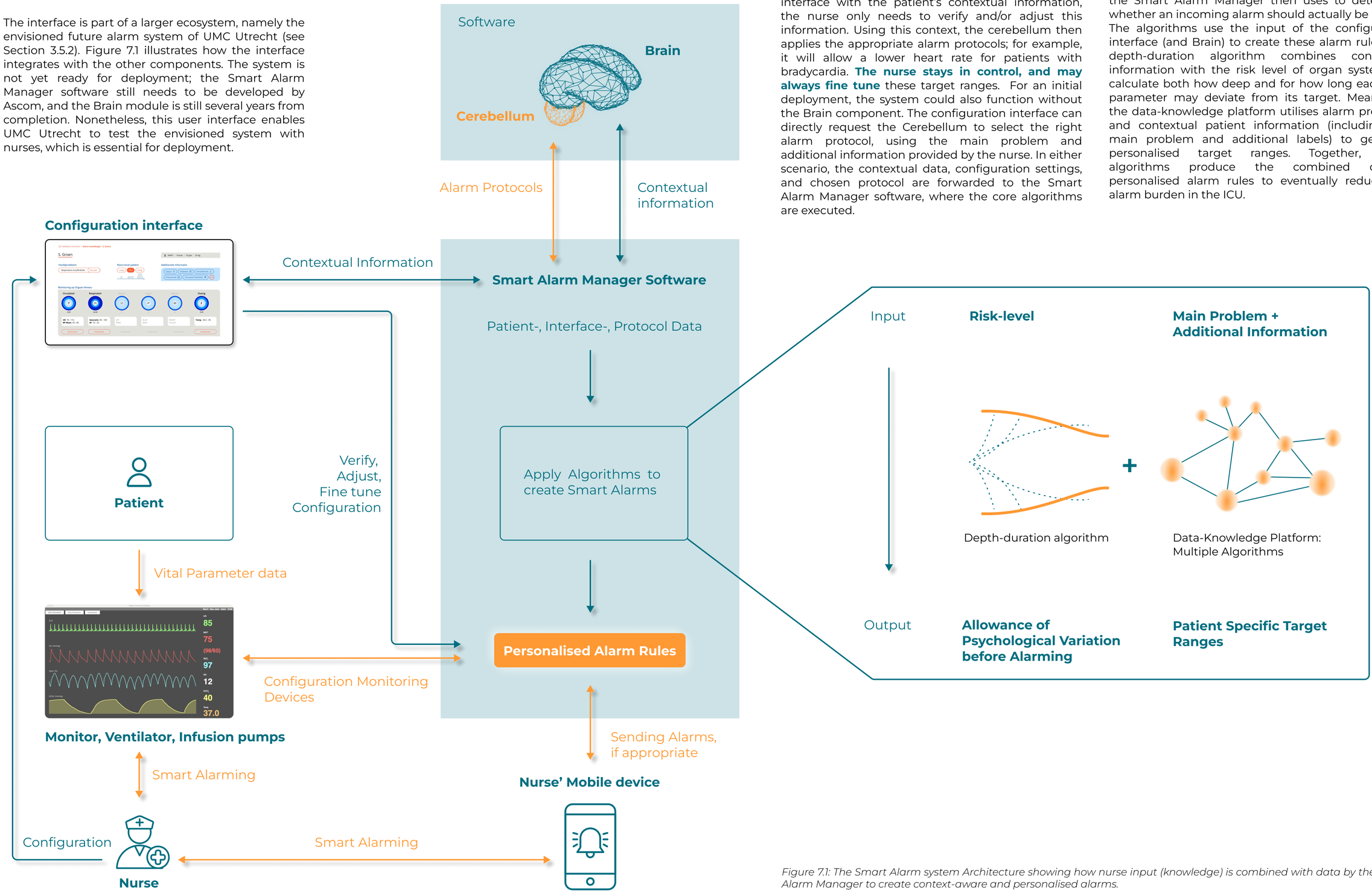
Keep track of where you are
The “breadcrumb” navigation helps to stay oriented and return to the patient or alarm overview with ease.



Hover & Slide
By hovering over the slider, arrows appear to guide the user to adjust to the desired target range.

7.2 System Architecture

The interface is part of a larger ecosystem, namely the envisioned future alarm system of UMC Utrecht (see Section 3.5.2). Figure 7.1 illustrates how the interface integrates with the other components. The system is not yet ready for deployment; the Smart Alarm Manager software still needs to be developed by Ascom, and the Brain module is still several years from completion. Nonetheless, this user interface enables UMC Utrecht to test the envisioned system with nurses, which is essential for deployment.



Component Functionality

The brain automatically populates the configuration interface with the patient's contextual information, the nurse only needs to verify and/or adjust this information. Using this context, the cerebellum then applies the appropriate alarm protocols; for example, it will allow a lower heart rate for patients with bradycardia. **The nurse stays in control, and may always fine tune** these target ranges. For an initial deployment, the system could also function without the Brain component. The configuration interface can directly request the Cerebellum to select the right alarm protocol, using the main problem and additional information provided by the nurse. In either scenario, the contextual data, configuration settings, and chosen protocol are forwarded to the Smart Alarm Manager software, where the core algorithms are executed.

The primary purpose of these algorithms is to generate a set of patient-specific alarm rules, which the Smart Alarm Manager then uses to determine whether an incoming alarm should actually be raised. The algorithms use the input of the configuration interface (and Brain) to create these alarm rules. The depth-duration algorithm combines contextual information with the risk level of organ systems to calculate both how deep and for how long each vital parameter may deviate from its target. Meanwhile, the data-knowledge platform utilises alarm protocols and contextual patient information (including the main problem and additional labels) to generate personalised target ranges. Together, these algorithms produce the combined output: personalised alarm rules to eventually reduce the alarm burden in the ICU.

Figure 7.1: The Smart Alarm system Architecture showing how nurse input (knowledge) is combined with data by the Smart Alarm Manager to create context-aware and personalised alarms.

Final Design

Accessible anywhere, from any screen

Go to Prototype