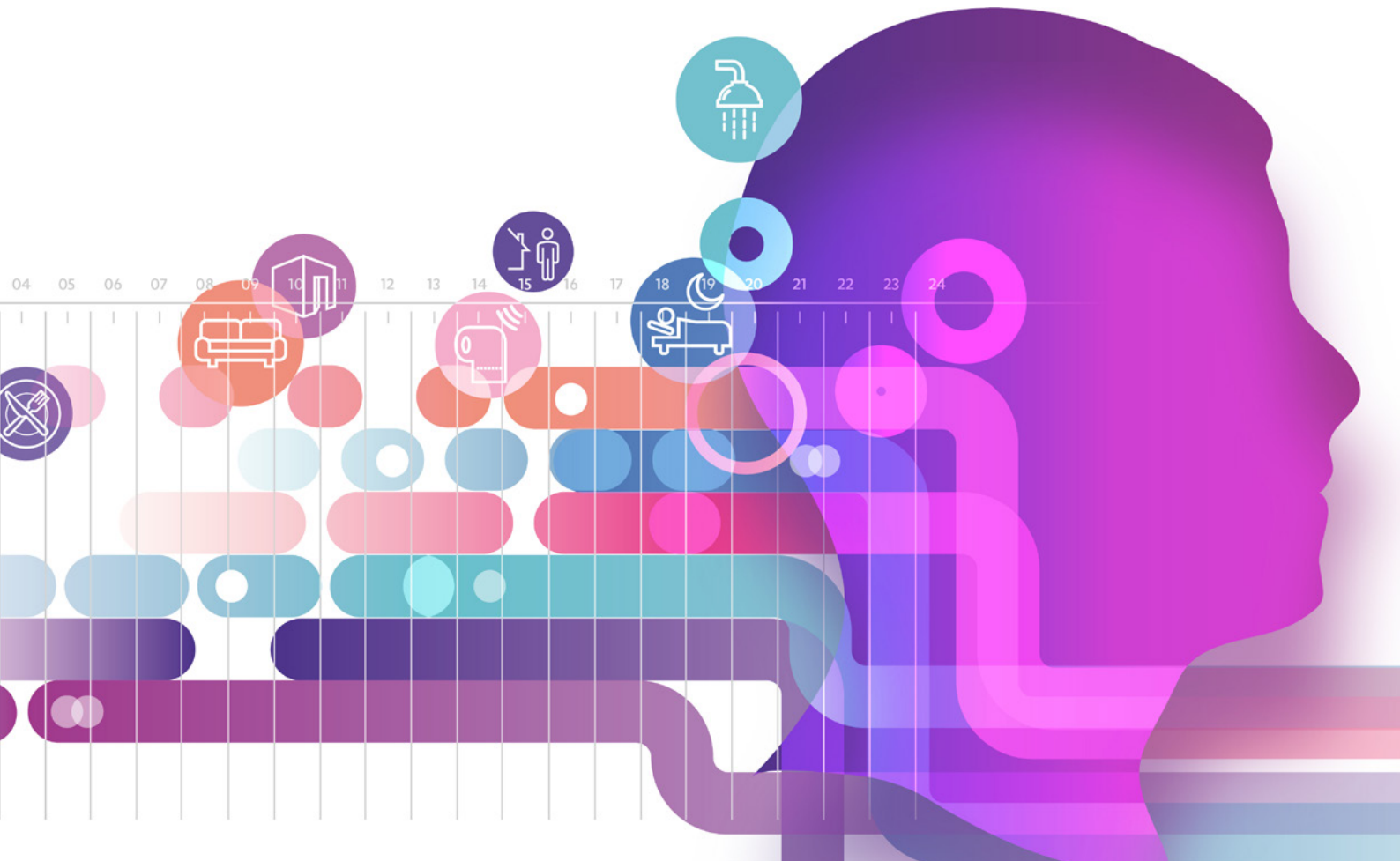


# Care@Home™

## Activity Monitoring



# 1. Using Artificial Intelligence to aid independent senior living

## From Passive to Active

The world of senior monitoring must, and has, developed from an industry in which the elderly customer is expected to initiate emergency calls to one where services have developed to a stage where service providers can be more proactive in their ability to protect their customers. In this world, technology is creating scenario where reactive response becomes a thing of the past and we are able to proactively and even predictively prevent emergency situations from occurring.

These services are enabled by intelligent use of activity data from the home that can be analyzed and create alerts that move the paradigm of the industry thus:



## What are the benefits of AI for senior monitoring?



Meaningful alerts are being detected with indications for Fall, sickness and deterioration in the medical condition:

- **Managing the aging process**
- **Onset of Alzheimer's**



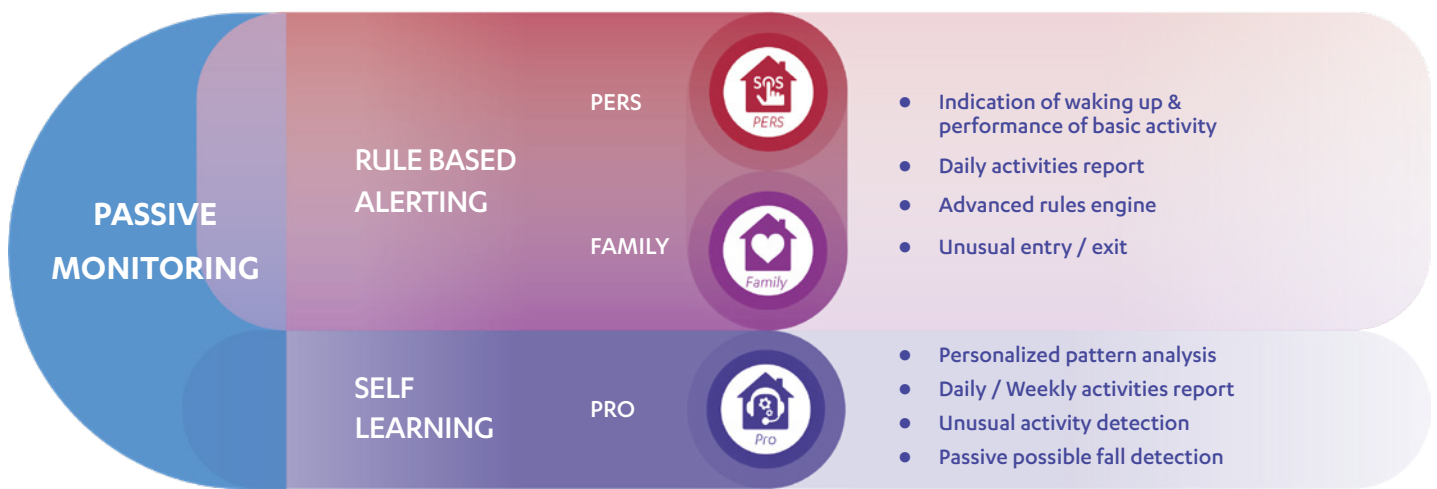
Enabling to quick intervention to:

- **Prevent additional deterioration**
- **Avoid hospitalization**
- **Even save lives**

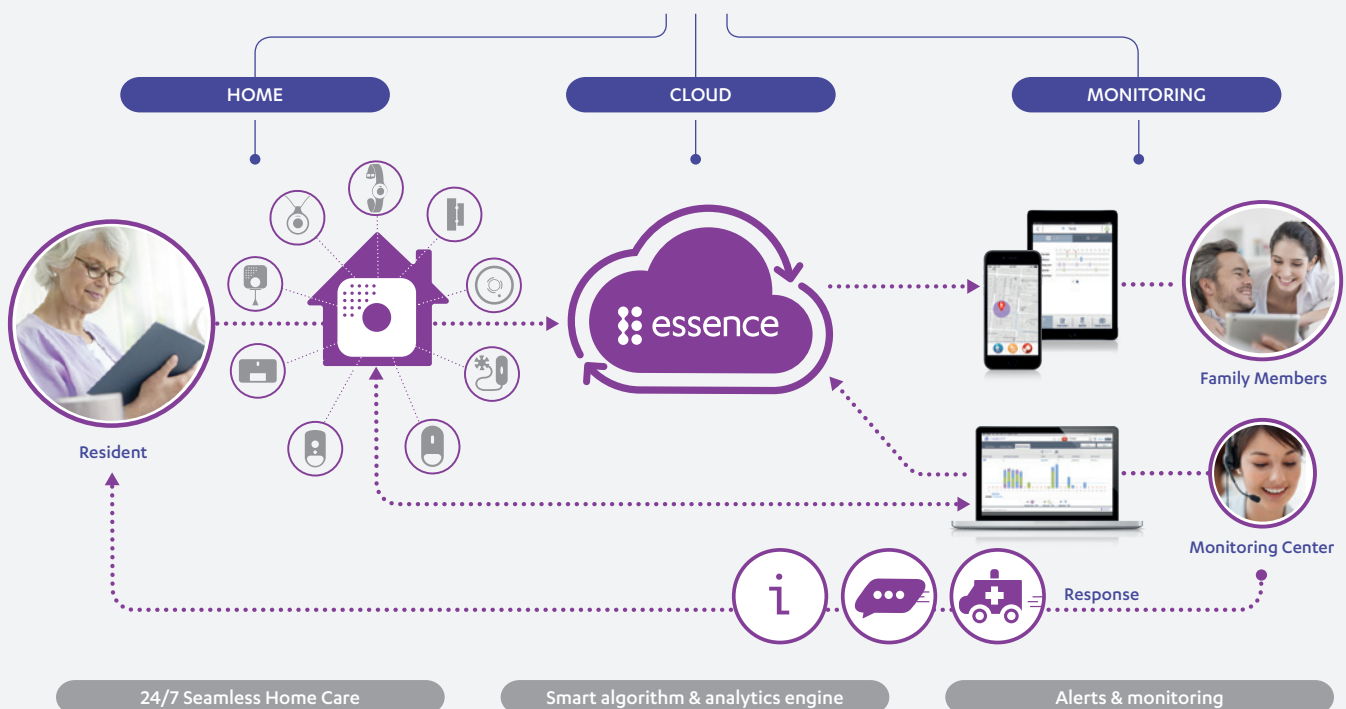
## 2. Care@Home™ Activity Monitoring

Care@Home™ Activity Monitoring platform is a comprehensive end-to-end aging-in-place solution that allows seniors to live independently and safely in their own home, knowing that help will be at hand when needed. Using non-intrusive sensing and detection devices and dedicated software, the system can follow a senior's daily activities and build a profile of them, allowing unusual activity or inactivity to be highlighted. Using the profile and continuing sensor readings, Care@Home™ identifies when there may be a need for assistance, and triggers an alarm to a monitoring center, family and caregivers.

Care@Home™ Activity Monitoring also offers the possibility to set Smart Rules to receive notifications of specific behavior of interest according to user defined parameters that are not dependent on regular patterns.



### The Care@Home™ Cloud Architecture



The Care@Home™ system consists of three main elements, each of which are to the overall functionality of the system in equal parts:



## 1. Detection and collection hardware:

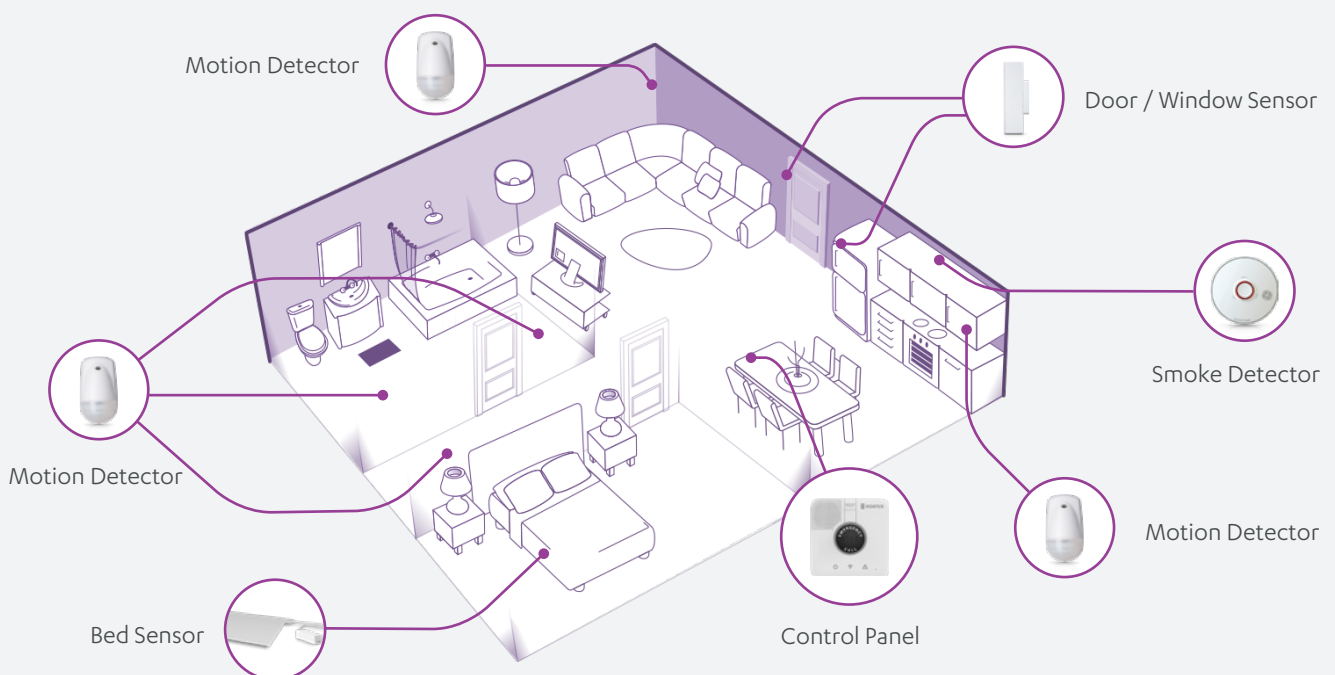
The Care@Home™ control panel and sensors are certified worldwide for use in the Social Alarm and PERS industry.

With correct installation, the motion detectors and door and window open/close sensors ensure accurate detection of movement and activity in the home. These readings provide the data that is used to create daily patterns of behavior that form the backbone of the intelligence used in the activity monitoring algorithms as explained later.



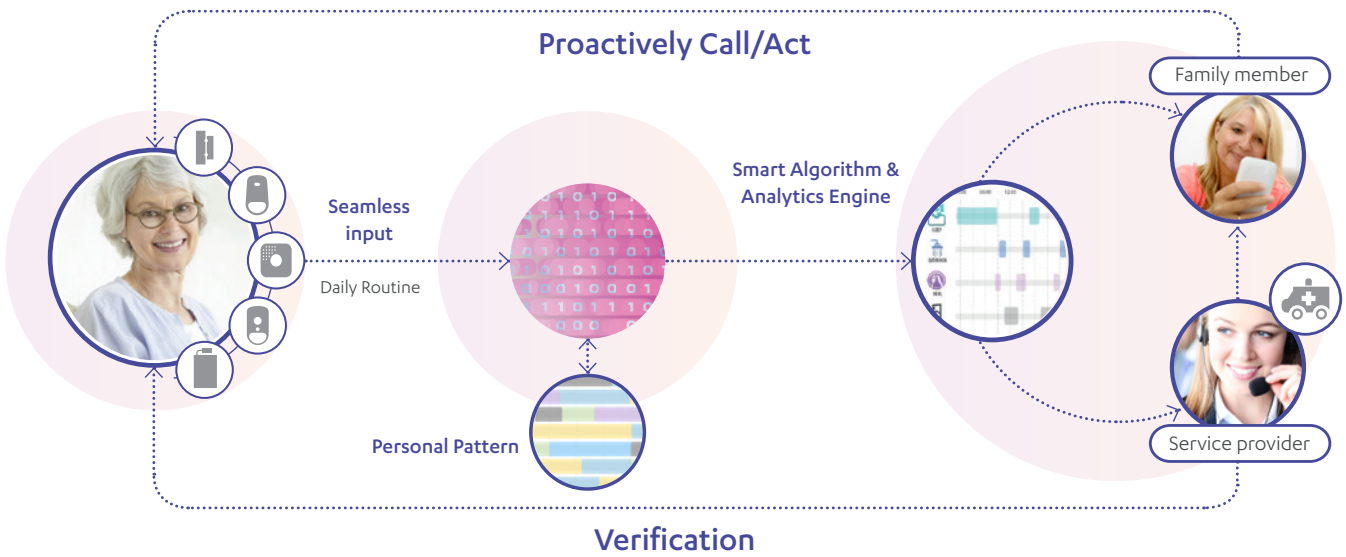
The Care@Home™ control panel, is certified worldwide for use in the monitored telecare industry (Social Alarm in Europe and PERS in the USA). It has several communications options with PSTN, GSM and Ethernet capabilities and also a backup power source.

The data from the various sensors is collected and aggregated on the control panel and then relayed to the Care@Home™ cloud for processing and analytics as will be explained later.





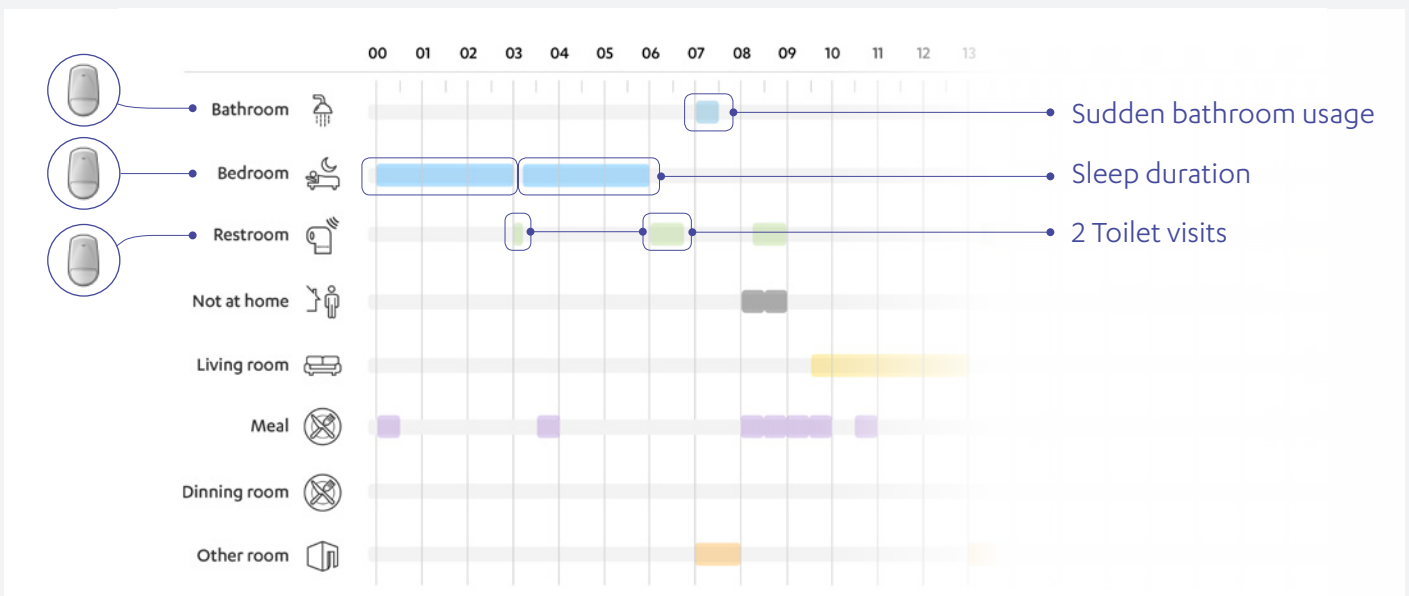
## 2. Cloud based analytics and rules



## Care@Home™ Pro Algorithm Overview

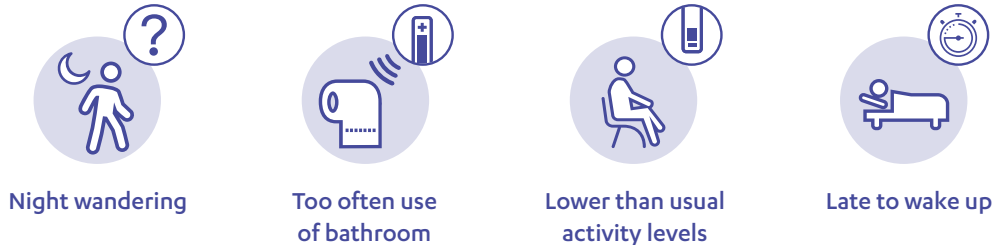
The basis of the Care@Home™ system is the ability to create a personal behavioral pattern that constantly learns the movement of individuals through passive sensors strategically placed throughout the home. These sensors collect data from user movement and doors opening/closing and uses it to establish a pattern detailing how the individual has spent their day. This includes exactly at what hours they have slept, when they have eaten, bathed, rested, in the living room, and spent time outside the house.

With the accumulated learned knowledge of the residents' behavioral patterns, the system is able to use its algorithm to detect when an event – or series of events - occur outside of the regular pattern of behavior, analyze the event and determine the type and severity of alert that is generated and sent to the healthcare service provider and the family members.

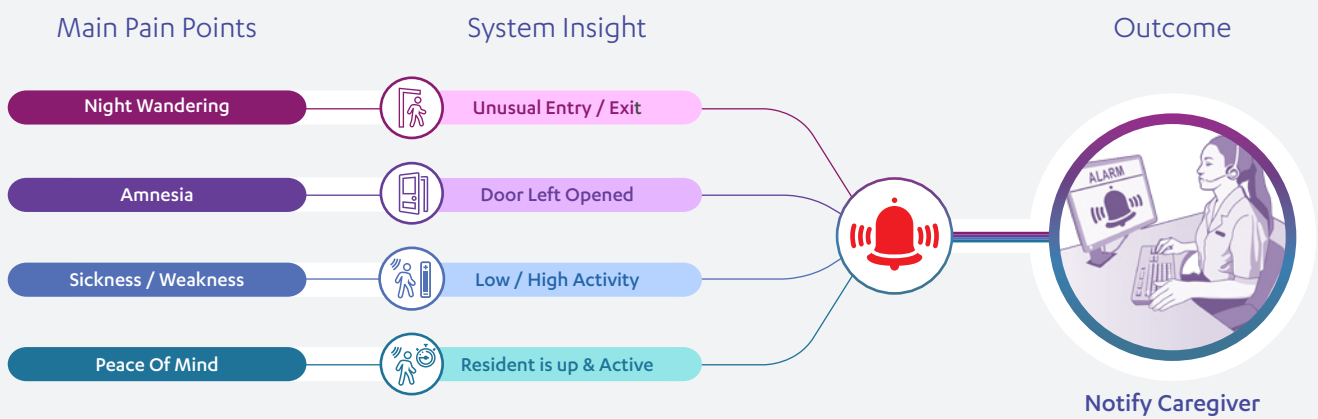


# Smart Rules Engine

Care@Home™ recognizes that there are instances in which service providers, carers, family members and even seniors themselves want to receive more customized alerts based on specific needs. Examples of these can be to receive notifications of:



Therefore, Care@Home™ allows service providers and cares to set Smart Rules that will send alerts pertaining to specific activities using several parameters. These rules can be used instead or in conjunction with the Care@Home™ behavioral pattern analytics described above to solve specific pain points.

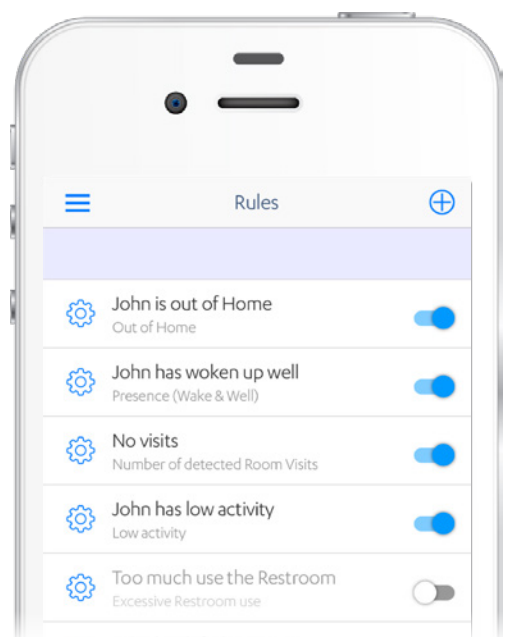


# Rules Configuration

Per each resident the admin/master user can add/edit the following rules:

- Out of home
- Wake & Well
- No. of visits
- Low/high usage in defined rooms
- Door left open
- Weekly activity index
- Unexpected entry/exit
- Panic button

When rule is activated the system will generate alert to a family member.



### 3. System Output: Intelligent Alerting

The central aim of the Care@Home™ activity monitoring system is to provide timely alerts that avoid health deterioration and the resulting outcomes both in terms of resident’s wellbeing but also in terms of cost. The financial burden of avoidable hospital stays or the need to move to a long term assisted living facility is a heavy one both for the individual and their family and also to the private or public health systems that provide the support. Below are some examples from actual patient cases that show a direct correlation between system output with the benefit of avoiding the need for further care.

#### Case Study 1:

Resident’s unusual activity level detected

**Female, 83**

**An Abnormal activity alert was received on Oct-18th**

**Events details**

- 19:58:00-08:00:00
  - Went to sleep at 19:58:00
  - Woke up 2 times
  - Woke up at 08:00:00
  - Slept for 11.78 hours, which is more than usual
- 22:35:00-08:00:00
  - Spent 10.02 minutes in the restroom at night
  - Went to restroom 3 times at night, which is more than usual
- 03:14:00-03:30:00
  - Unexpected bath at night!!!

In this situation, of an 83 year-old female resident, an alert was raised when, over a sustained period, a number of events were recorded that were not part of her regular activity pattern.

Using all of these events in unison, the system decided that it was a signal that the lady in question was probably experiencing poor health and had not notified anyone. The event was sent to her care provider who, after contacting her, decided that it was not an immediate emergency situation, however, it was necessary in this case to send a doctor to check on her.

The doctor determined that the resident had been getting sick for a number of days and took action to prevent further deterioration.

**Weekly Activity**

10/12/2018  
10/13/2018  
10/14/2018  
10/15/2018  
10/16/2018  
10/17/2018  
10/18/2018

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Bathroom  
 Bedroom  
 Meal  
 Not at home  
 Living room  
 Restroom  
 Dining room  
 Other room

**Monitoring station called the resident**

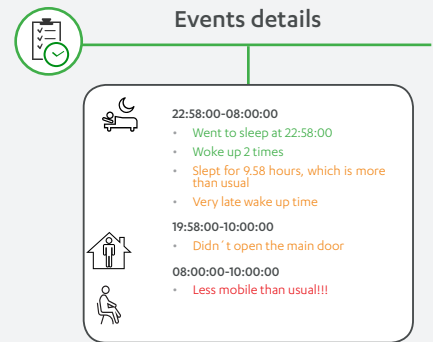
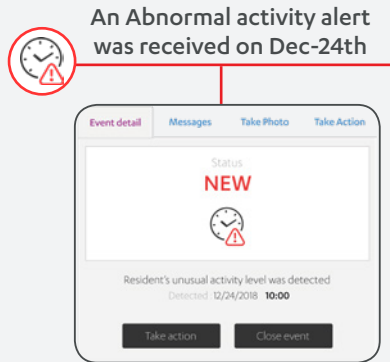
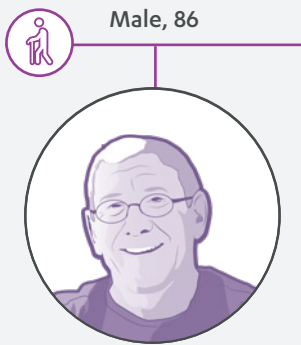
**Turned out she hasn't been well for several days**

**Received treatment and avoided probable serious condition**



## Case Study 2:

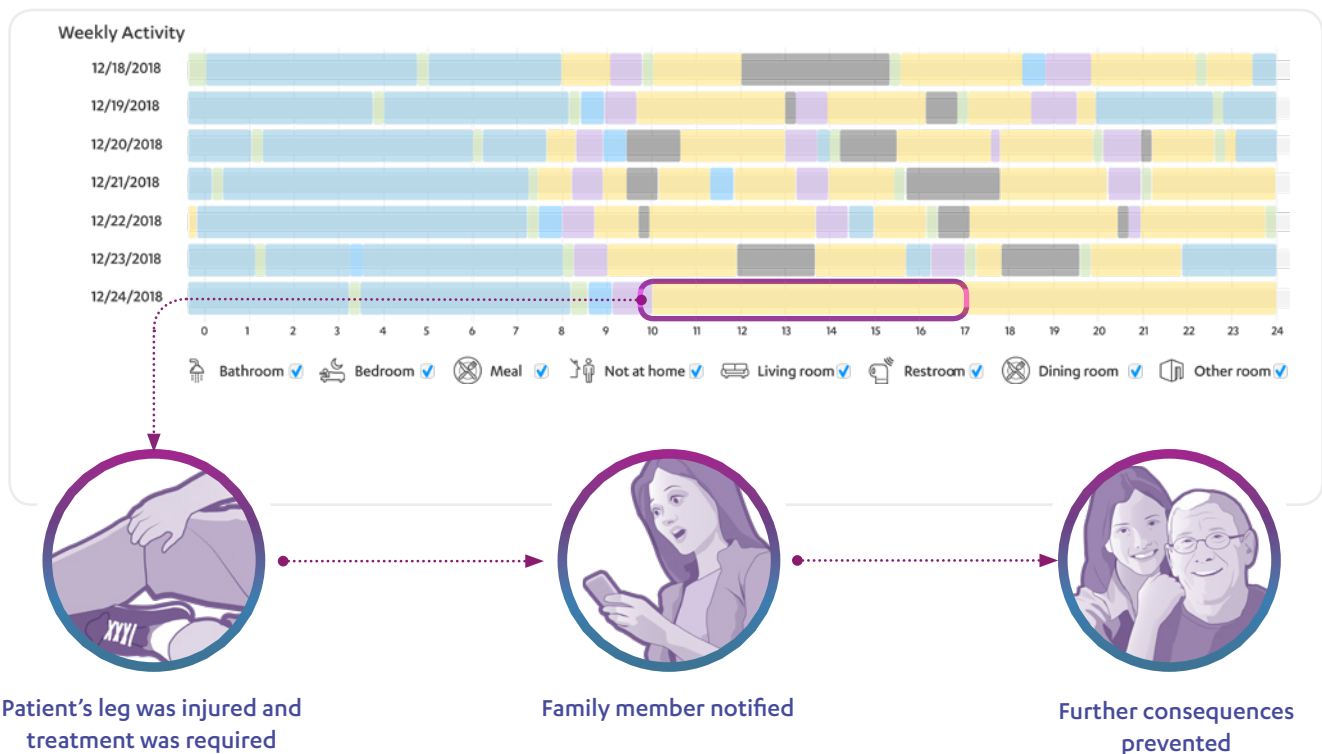
### Resident's partially incapacitated



The senior male is generally very active, even for his relatively advanced age, as can be seen from his personal “day story”. He moves often around his home, eating and bathing on a regular basis.

On the morning in question, he began normally. However, as can be seen on this diagram, the gentleman stopped his regular activity and seemingly did not move for many hours during that day. After a certain time period had elapsed, it can be seen that he had not eaten his regular meal and had not moved to use the facilities or go to his bedroom as his regular behavior pattern indicates that he would do.

Following a certain time period, his family was notified, and it was discovered that he had a minor leg injury that was preventing him from going about his regular daily activities. Aside from the obvious need to treat the injury, extended inactivity in seniors can leave to other complications which have been avoided in this situation.







## Summary

- Care@Home provides a basis for monitoring senior activity from manual emergency alerts all the way to intelligent activity analytics
- By tracking a resident's activities the system can notify caregivers of that important daily event have, or have not, happened.
- Using data analysis, the system can prevent emergency situations and identify a change in general condition
  - Improving residents' safety and wellbeing
  - Ensuring their families' peace of mind
- Care@Home Activity monitoring offers obvious social and financial benefits:
  - Keep seniors living independently at home for longer
  - Prevents costly hospitalizations and the need to move into elderly care facilities prematurely

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For more information, please contact:

**Essence SmartCare Ltd.**

12 Abba Eban Avenue,  
Ackerstein Towers Bldg. D  
Herzliya Pituach, 4612001 Israel

Tel: +972-73-2447777

Fax: +972-9-7729962

[www.essence-grp.com](http://www.essence-grp.com)

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