RESILIEN-T

Technology driven self-management for building resilience among people with early stage cognitive impairment

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Deliverable D1.3 – Market analysis lifestyle monitoring

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4				
5				

1. Content

List of Figures

List of Tables

List of Acronyms

LSM: LifeStyle Monitoring

PwCI: Person with Cognitive Impairment

Executive Summary

The document is a deliverable of WP1, as a product of T 1.4: Market analysis of lifestyle monitoring systems in the involved countries followed by contacts with selected suppliers of lifestyle monitoring to ask if their system can be integrated in RESILIEN-T. This for the RESILIEN-T Home version. In D 1.1 a first version of this market analyses was incorporated and is further elaborated in this deliverable.

Main conclusion: there are a number of suppliers of Lifestyle Monitoring Systems active on the EU-market, in the UK and Israel. In a logic deduction process 2 LSM-systems are selected for potential integration for RESILIEN-T Home, one is on market in The Netherlands and one is near market in Switzerland and probably Italy. Both are direct off-springs of former AAL-projects.

1. Introduction

As described in D 1.1 the design concept will be instantiated through the three different configurations designed for the Resilien-t system:

1. Resilien-t Basic
2. Resilien-t Plus
3. Resilien-t Home

The first, the Basic version is designed for people who are unfamiliar with technology and who doesn't have much interest in using devices. The user is motivated to use the system, leveraging his personal interests and passions. The aim is to create meeting points with his life experience.
This Resilien-t basic version will provide the PwCl and the informal caregivers with a mobile App to deliver coaching services related to nutrition, physical activity, cognitive exercises and social relationships. The App will interact with a remote, cloud-based platform, designed to collect all the data generated from the user's interaction with the App (on one side), but also acting as a repository/feeder for the contents delivered to the user through the App, like cognitive training games, information about caring or suggestions on nutrition and physical activity. The tablet of Compaan will be used which includes remote management by the informal carer supporting the PwCl.

The second version called Resilien-t Plus provides for integration with wearable sensors, such as a smartwatch. This version is designed for people with greater technological knowledge and who are interested in the data visualization and monitoring of their physical condition. The basic system will be integrated with a wearable sensor - smart band/smartwatch - to collect feedback on mobility, physical activity and general activity of the person.

The third configuration is the Resilien-t Home providing sleep monitoring sensors and home lifestyle sensors to introduce the Home version of Resilien-t system. That is to collect new data from the control for amongst others sleeping habits or indoor mobility. From the Description of Work: **''The integration with a selection of lifestyle monitoring systems (depending on the on market systems in the pilot countries) will be built to offer integrated solutions.''**

In D 1.1 paragraph 3.1.6.1 possible sleep monitoring sensors are enlisted. With home lifestyle sensors are meant the specific life style monitoring systems with as main target group alone living people with dementia in the different phases of dementia. In different countries these systems are on the market and in use. Some of them are direct off-springs of former AAL-projects. They may coexist in their own proposition and distribution channels, provided that they can feed data to the platform according to the requested APIs, data formats and specifications. The other way round: The choice of offering an open API by RESILIEN-T to integrate lifestyle monitoring systems from different suppliers will increase interoperability and open different market channels.

The system architecture consists in a tablet, applications (app) and the remote portal on a cloud-based platform. The architecture is realized to introduce sensors and devices in the same infrastructure to demonstrate the modularity and adaptability.

Figure 1: The three different configurations of the RESILIEN-T platform

1.1. Purpose of this document

T 1.5 is described as: ''Market analysis in the involved countries followed by contacts with selected suppliers of lifestyle monitoring to ask if their system can be integrated in RESILIEN-T". In D 1.1 a first market analysis of life style monitoring systems on the EU-market is presented. This is further elaborated in this deliverable.

2. What is a lifestyle monitoring system (LSM)?

2.1. Generic description

A system for lifestylemonitoring (LSM) uses in principle a network of sensors. An (in)formal carer can monitor changes in the trends in the daily patterns of an alone living person by using an app. The more advanced systems uses artificial intelligence for learning the daily pattern for instance the first 2 weeks. After this learning period the systems generates notifications on relevant deviations from the daily pattern.
The report "ICT & Ageing -European Study on Users, Markets and Technologies" prepared by Empirica and WRC on behalf of the European Commission, Directorate General for Information Society and Media in 2010 analized the market of telecare solution and have defined three different kind of solutions:

- First-generation: uses a simple telephone unit and a pendant with a button that can be triggered when help is required by the user; a call centre receive the call and identify the caller and their address; initial diagnosis of the nature and urgency of the need can be explored by voice link; nominated response personnel (informal or formal carers) are alerted as required by the situation, following an established protocol
- Second-generation: this adds a 'passive' or automatic alarm dimension (no need for the older person to actively trigger the alarm) enabled by the implementation of sensors such as smoke, fire and flood detectors, among others, in the older person's home; when activated, these trigger an alert to the call centre and initiate the necessary response
- Third-generation: these are a more advanced type of telecare service, which collect everyday activity data automatically through various sensors such as front door open/close detectors, fridge open/close detectors, pressure mats, bed/chair occupancy and electrical usage sensors; data is presented to care personnel or family carers to monitor wellbeing and assess the need for help and support.

The potentiality of the third generation solution that include lifestyle monitoring in meeting needs of people with dementia and their carers was clear already in 2010.

The main target group are alone living people with dementia, with best usage from the stage (early) moderate dementia onwards. The most important functionality is early warning on crisis situations.

Specific LSM systems can also be used for direct surveillance on falls and/or wandering with alerts, for instance an alert on leaving the house. Some systems have their focus more on these surveillance functionalities and lesser on the LSM. LSM is in this case more secondary in the proposition. This of importance for the partner choice for RESILIEN-T: see the next chapter.

2.2. Lifestyle monitoring in functional requirements

Lifestyle monitoring (LSM) can be defined in terms of a sequence of functional requirements. For each requirement a categorization is mentioned according to the MoSCoW-method: Must Have – Should Have – Could Have – Wish. As interim a distinction is made between Must Have and Wish-functional requirements.

Must have:
LSM gives insight in the daily life pattern of alone living persons with a slow deterioration, mainly alone living persons with dementia. Informal carers and care professionals (district nurses) can determine changes in the daily life pattern by monitoring of the daily activity. The LSM-system active registers unusual changes in the daily lifepattern. These unusual changes can give clues for a risky step in the process of deterioration.

LSM generates early warnings for a (potential) crisis situation, with as example an urinary tract infection, based on an more than usable use of the toilet. As another example: more activity in the night in the house, which can be an indicator for nightly restlessness/wandering.

A system for LSM is a combination of network (or grid) of sensors in the house, interpreting & analysing software and an smartphone-app and/or an online portal for the informal carer. A district nurse has the possibility to monitor several home care clients with LSM in an overview.
LSM has a network or grid of sensors. Most sensors are passive infrared sensor (PIR-sensor) and magnetic close/open sensors. There are no cameras. The sensors are installed in several rooms of the house.

Targetgroup: The most important targetgroup are alone living persons with dementia. LSM is based on practice at least applicable from the starting fase of the moderate fase of dementia with as major functionality the early warning on (potential) crisis situations. LSM is besides this main targetgroup applicable for alone living people with other diseases with a more or less slow but progressive deterioration. For instance people with Parksinson disease with as main goal the in time detecting of a higher risk of falling.

Wish:
The passive infrared and magnetic sensors can be installed by the informal caregivers, with support of the manual, the app and if possible videos.

Must have:
Behind the network of sensor software registers over a longer period the movements and/or activities of an (elderly) inhabitant of a house. On a smartphone, tablet or PC the informal carer and/or the care professional gets information on the activities of the inhabitant. With as examples toiletusage, leaving and entering the house, going to bed and out of bed, activity in the kitchen etc.

The daily life pattern of the person of dementia is learned in by the LSM-software (artificial intelligence). After the learning period the system generates notifications in for instance the smartphone app on the moment the LSM-system registers a for the person unusual lifepattern on a certain aspect.
Or: the system has adjustable thresholds values to be adjusted by the informal carer and/or the care professional.

The communication towards the informal carer and/or care professional has the colour-design of a traffic light:

- Green: everything ok, conform the usual daily life pattern
- Yellow: a remarkable, unusual change in the daily life pattern. But with no direct potential danger
- Red: a remarkable, unusual change in the daily life pattern. Direct attention needed.

Yellow and red aspects are brought direct under attention by notifications in the app etc. The red notifications in an extra manner, for instance as a push notification.

Wish:
If visit or professional care is present in the house the LSM is deactivated automatic. If the visiting person or the professional carer leaves the house - and if the software concludes that there is still 1 person in the house – the LSM is reactivated automatic.

Wish:
The yellow and red notifications are automatic inserted in an electronic patient dossier. Within the dossier these notificaties are made visible in an timeline in which also reporting remarks from the involved care

professionals are visible.

Wish:
Emergency situations, for instance falling, are detected 24 hour/7 days and sent out by a red notification. The reaction term for this functionality based on LSM is maximum 2 hours in for instance the night situation. With preference for a faster reaction term.

Wish:
The possibility of a red notification if an inhabitant is leaving the house (=wanderdetection). The informal carer can program time periods of activation during the 24-hour period. The informal carer can also program a time delay after the moment of leaving the house: for instance a red notification if the inhabitant is not returned in the house after 15 minutes.
With preference of: alone a red notification on wandering if there is 1 person in the house and this 1 person is leaving. Persons who are going in the house and mainly again leaving the house don't result in false positive red notifications if there is still one person in the house.

3.Suppliers of Lifestylemonitoring & selection

3.1 An overview of suppliers

In D 1.1 an overview of suppliers of LSM was already presented. An actualized version of this overview:

Table 1: LSM systems on market or near market, march 2020

Lifestyle monitoring systems	**Company**	**Country of origin** **On market**	**On market in**	**Compatibility**	**Remarks**
SensaraCare	Sensara	The Netherlands	NL, some EU-countries, USA	Android, IoS	Off-spring AAL-project ROSETTA Current marketleader in The Netherlands Direct sales to informal caregivers, by company Jinca
Smart Lifestyle GateWay/Livind System	Open XS	The Netherlands	NL	Android, IoS	
Canary Care System	Canary Care	UK	UK	Android, IoS	
Care@Home	Essence	Israel	Israel, via FocusCura in NL under cAlarmSense + other EU-countries	?	Focus on surveillance
eLea	MariCare	Denmark	Denmark & (at least) NL via New Care Solutions	?, at least Android	Focus on surveillance Market leader in Denmark
DomoCare Home Health monitoring solution https://www.domo-safety.com/de/ https://enovationgroup.com/umo-partners/nl/product/domocare/	DomoSafety	Switzerland	Near market/on market ? Switzerland, as off-spring of AAL-project Home4Dem perhaps in other involved	at least Apple	Off-spring AAL-project Home4Dem

			countries such as Italy		
AlleenThuis (=Dutch, HomeAlone)	AlleenThuis	NL	NL	?, at least Android	No sensornetwork, only sensor, under one of the bed legs

3.2 Selection of relevant partners

In the discussion of which LSM-systems are relevant for partnering for building an integration in RESILIEN-T the next considerations are of importance:

- RESILIEN-T has as targetgroup people with (mild) cognitive impairment. The LSM-systems have mainly – until now – the targetgroup alone living people with dementia. From the phase moderate dementia onwards till the phase of severe dementia with for instance wandering and falling without the possibility anymore to use an alarmbutton.
- The LSM-systems Care@Home and eLea are more focused on surveillance on falling and wandering next to lifestylemonitoring. The main targetgroup for these systems are the people with more severe dementia. That's why there are not included.
- Canary Care Systems is only in the UK, and not in one of the RESILIEN-T-countries. Is not included.
- Alleen Thuis/Home Alone is in principle a LSM-system, but limited. Is not included.

Possible candidates are: SensaraCare and DomoCare Home Health Monitoring Solution. Both are off-springs of AAL-project and with a least partly focus on people with moderate dementia (see below). For DomoCare with the assumption that with involvement of INRCA as projectcoordinator and other Italian of the orginal AAL-project Home4Dem the system will also be brought on the Italian market and not only on the Swiss market. On this moment it is confirmed that DomoSafety is trying to enter the Italian market.

What is of importance that SensaraCare and DomoCare both have the same 2 different use cases or propositions. For DomoCare is this visible on the project website of the AAL-project Home4Dem, under businessmodel (http://home4dem.eu/project/business-model/):

Two different Use Case Models have been developed:

1. In Use Case Model A, the ICT solution will be a product, freely purchasable by families in the private market as an answer to their personal needs (e.g. safety, control, prevention, etc.). Use Case Model A will be tested during the project in Italy and Switzerland.

2. According to Use Case Model B, it will be possible to employ the ICT solution as a tool to improve the effectiveness of existing care services. In this case, the professional caregivers will be users as well, and will have access to some of the information generated by the ICT solution. This will allow them to better tailor the care provided to the person with dementia and even react in case of adverse events (e.g. when an emergency alarm is triggered).

For the on market system SensaraCare this is exactly the same. There is made a difference between:

1. The business-2-consumer (B2C) model in which the system is direct sold to the informal carer of a person with dementia. This in The Netherlands done by the company Jinca: https://www.jinca.nl/diensten/leefstijlmonitoring/

2. On the other hand the business-2-business-2-consumer (B2B2C) or the homecare proposition in which the LSM-system is sold to homecare organizations for using the LSM-system at their clients.

Next are the principles:

1. In the B2C-model the system is 'lighter'' and also cheaper: less sensors and less functionalities in comparison with the homecare version. The B2B2C-Homecare version has an extra specific bedsensor and extra software & support for the involved care professionals.

2. There is a grow-model: the B2C LSM-system is lighter because when it purchased in the B2C/direct sales model by the informal carer the person with dementia is in principle in the mild/moderate stage of dementia. In this stages of dementia in The Netherlands the homecare is not yet involved if there are only cognitive problems. The homecare is involved from end moderate/severe stage of dementia onwards.

For RESILIEN-T is then of importance to focus on the systems-versions for the use case/proposition B2C, direct sales to the informal carers, because RESILIEN-T is focusing on the MCI-stage. This is direct before the mild/moderate dementia stages, with in practice some overlap. Meaning the ligther/basic versions of the LSM-systems. For The Netherlands this means that Jinca is also a partner next to Sensara.

3.3. A consideration

A consideration is that research and experience in practice shows that the LSM-systems are until now scarce used in the mild/moderate dementia stages in The Netherlands. In The Netherlands the B2C businessmodel/use case is not really successfull until now. Of the Sensara operational LSM-systems numbering up to 1200 systems most – 90% - are operational in B2B2C-model, at clients of homecare. Meaning in the end of moderate stage and severe stage of dementia.

3.4 Data of LSM-systems that can be used for RESILIEN-T Home

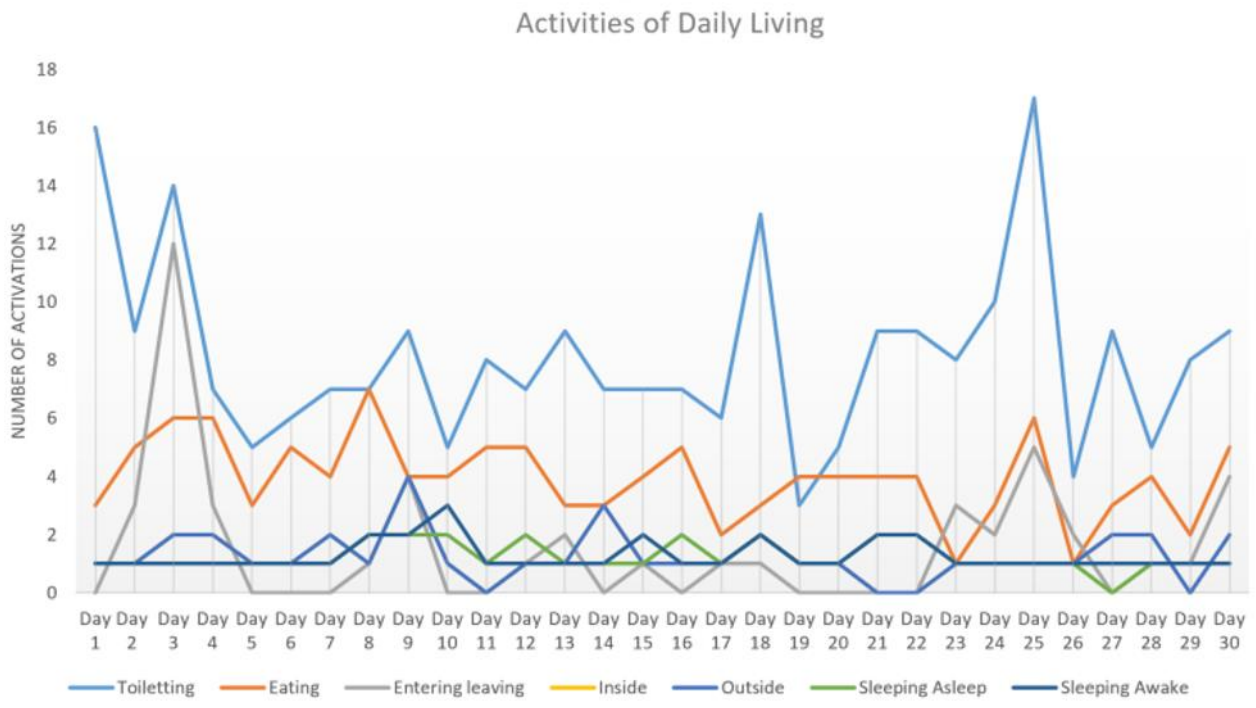
Of the to be launched system DomoCare the elements of daily life that are monitored are not known in the actual situation. For the SensaraCare LSM-system the monitored elements of daily living in the basic version are:

- Walkingspeed inside the house
- Inside/outside the house*
- Activity in the kitchen*
- Being in bed (= not the same as sleeping)*
- Level of activity inside the house*
- Toiletusage
- Visits to the house/social interactions*

For instance: the LSM-systems sends a yellow notification if the number of visits over a period is decreasing in comparison to the usual pattern in the period before. The number of visits per day can be monitored in a graph.

As an illustration a graphic of the monitored elements:

Figure 2: Graphic of the monitored elements during a certain period (Sensara-system, source UNIVPM)



The potential useable elements for RESILIEN-T in relation to the targetgroup PwCI are marked by a *.

Comments on this are:

- For support on the selfmanagement for nutrition is relevant: activity in the kitchen
- For support on the selfmanagement of physical activity are relevant: inside/outside the house, being in bed, level of activity inside the house
  Specific bedsensors, as described in D1.1. as also a part of RESILIEN-T Home, have an overlap with the monitoring element being in bed of LSM-systems. This type of sensors generates more specific data on the sleep itself.
- For support on the selfmanagement for social relationships is relevant: visits/social interactions