Ambient Assisted Living Joint Programme

Call 1

D7.1: Investment Prospectus

Proposal full title:

SOFTCARE: UNOBSTRUSIVE PLUG AND PLAY KIT FOR CHRONIC CONDITION MONITORING BASED ON CUSTOMIZED BEHAVIOUR RECOGNITION FROM WIRELESS LOCALIZATION AND REMOTE SENSORING

Proposal acronym:
SOFTCARE

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Participant no.*	Participant organisation name	Part. short name	Country & Funding Agency*[2]
1 (Coordinator)	Centre de Recerca i Investigació de Catalunya	CRIC	Spain (Ministry of Industry, Tourism and Trade)
2	Forschungsinstitut des Wiener Roten Kreuzes	FRK	Austria (Federal Ministry for Transport, Innovation and Technology)
3	MeshWorks Wireless Ltd.	MWW	Finland (Finnish Funding Agency for Technology and Innovation)
4	HealthSystems Group	HEALTHSYSTEMS	U.K. (Technology Strategy Board)
5	Central European Institute of Technology	CEIT	Austria (Federal Ministry for Transport, Innovation and Technology)

Summary

This document contains the documentation that was used to approach potential investors or commercial partners. It is main structure in two different sections, a pdf-like document that summarized the technical requirements and capabilities of the SOFTCARE system and two presentations used for showing the commercial and technical details.

Contents

1. Commercialisation

Research project funded by the Ambient Assisted Living (AAL) program.

The **SOFTCARE** system is a fall detection solution for elderly people living independently with some degree of home care. The platform is conceived as a Wireless Sensor Network (WSN) based on the well-known *Zigbee* protocol enabling low power-wireless applications. The main devices are:

- *The bracelet*: light and comfortable accelerometry-based device incorporating a panic button.
- *The static nodes*: small devices plugged at the user's home (one per room) acting as signal repeater and allowing the user location when indoors.
- *The gateway*: device acting as network sink, being the '*decision maker*' that establishes the voice communication channel towards carers if a hazardous situation is detected. For the current prototype, a notebook is used for this purpose.

1.1 Why SOFTCARE?

The SOFTCARE system uses a bottom up approach thought to fit the both the end users' as well as the telecare providers' needs. The main advantages are:

- **Easy deployment:** one static node is plugged in each room, the bracelet is worn on the user's wrist and the gateway of the SOFTCARE application is activated, that's it!
- **User acceptance:** the bracelet is small, light and well designed so it does not stigmatize elderly people's fragility. Additionally, the system does not cause privacy concerns as only acceleration samples from the user arm are sent to the gateway.
- **Ubiquity:** as the bracelet is comfortable, it can be worn while performing all daily activities (a water proof concept is planned for future releases).
- **High reliability:** artificial intelligence algorithms are implemented on the gateway where the final decisions are made. Both fall detection reliability and false alarms avoidance significantly increase with respect to those solutions which perform the fall/no fall decisions within the device worn by the user.

1.2 Features

The information related with the features listed below is uploaded to the SOFTCARE server and displayed through an on-line platform. The data is organized to be understood at a glance by the carers (events table, graphical representation of trends, etc.) and ease the care provision and management.

- **Automatic fall detection:** a call to the carer is automatically launched if a fall is detected.
- **Panic button:** an immediate communication towards carers is enabled if the bracelet's button is pressed by the user.
- **Activity recognition:** some activities of daily leaving (ADLs) can be recognized using leading pattern recognition techniques. Currently, the system is able to distinguish between: walk, rest, cook and eat.
- **User activity level assessment:** the different activity levels can be inferred from the motion analysis. For instance, the classification can be: high, medium, low or no-activity.
- **User location:** the SOFTCARE system is capable to locate the user with room precision.

1.3 How does the system work?

The system can be deployed easily at the user's place only by plugging the static nodes into the power outlets, running the SOFTCARE application on a small notebook and delivering the bracelet to the user.

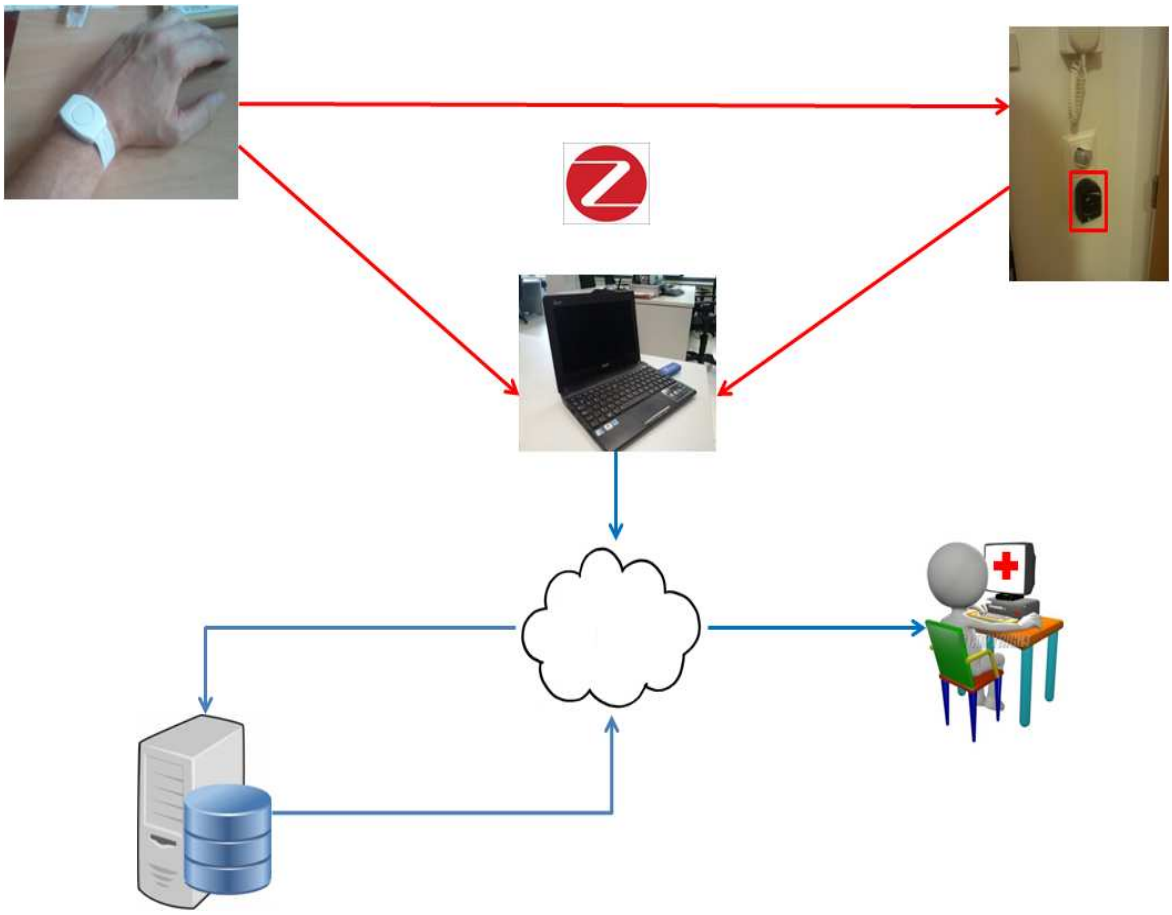
After these quick steps, the final user must perform the system training to allow the activity recognition and the indoors location. In the first case, the user will perform the different activities that the system currently supports. The time during which the user needs to train the system ranges between 10 minutes (cooking and eating) and 2 minutes (walking and resting). On the other side, location training will be performed by moving through each room for 4-5 minutes. Location training can be done by the carer without impacting system performance. The fall detection and activity level assessment features do not require any training.

When a fall is detected or whenever the user presses the panic button, a direct voice communication link to the preferred carer is established through the cloud using the Skype API.

1.4 System architecture

The acceleration data is locally gathered using the Zigbee protocol for low power wireless sensor networks. The notebook is the sink of the gathered information and acts as the gateway to carers. Additionally, it is the "decision maker", meaning that is responsible of analysing the data and for taking proper actions in case any hazardous situation is detected. The notebook uses the cloud to update the user location in a minute rhythm and the activity related information on a server database currently placed at CRIC's facilities in Barcelona. On the other hand, if a fall is detected or the user

presses the panic button, the notebook immediately adds a new event (fall/alarm button) on the server database and locally launches a call to the preferred carer. Using an Apache-based application, the information on the server database is clearly displayed on the SOFTCARE's web site easing care management. An Ajax-based application refreshes the information on the website regularly to ensure that the displayed data corresponds to actual events so that carers can track the users real time simply by accessing and browsing the web.



1.5 System requirements

With the current approach, apart from the main modules(i.e. the bracelet, the static nodes and the notebook-gateway), the SOFTCARE requirements are:

- A dedicated server running MySQL and Apache Tomcat;
- A PC on the carer side to manage care delivery;
- Some kind of internet connection (wifi, 3G stick, etc...) must be available on the end user's home.

All the software related to the activity recognition, fall detection and user location is implemented using JAVA so eventual maintenance tasks on the gateway placed on the end-users home can be done swiftly.

2. Investor presentation

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Contents

- The Market Survey
- Contacts with potential industrial partners
- Planning for exploitation
- Go to market scoping

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Softcare Market Survey

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Softcare Proposal: Commercial Assumptions

- 'a home-based kit which will help detect behaviours as related to patient's condition'
- 'a permanent automatic proactive care guard for the elderly'
- Focus on patients with co-morbidities and more than one patient at a time
- 'constant location and health sensor tracking'
- 'early detection of chronic conditions'
- First zigbee solution with voice
- 'at an affordable cost', 'easy to install'
- 52000 sold installations by 2015 or year 5 after RTD @ cost per unit of c. €380
- A start-up company post RTD to commercialise the product: HSG (Capex) to be involved in maintenance of expert behavioural detection module and further RTD, commercialisation routes and sales and marketing.
- Post project 10 months required to develop a marketable product, during which FRK will carry out dissemination activities

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Survey Design

- User requirements analysis
  - Literature review
  - Develop information gathering pro-forma
  - Select 3 case study sites (suggest UK, A, E)
  - 2 Partners submit report from case study site
- Market situation analysis
  - Literature review
  - Develop information gathering pro-forma
  - Gather information
  - Analyse and report
- Product requirements analysis
  - Literature review
  - Develop questionnaire
  - Gather information
  - Analyse and report

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The nature of the market revealed

- There are major barriers for new entrants
- There are also important exit barriers for end users of telecare services
- The threat of substitute products is not currently significant
- The market is attracting large numbers of new competitors
- The intensity of competitive rivalry is high, but may soon get much higher
- The bargaining power of customers is considered low
- The bargaining power of suppliers is strong

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Key Findings from Market Survey

- Original Softcare concept does not meet key user and to a lesser extent product requirements.
- Two areas have particular promise for Softcare:
  - falls detection; and
  - solutions for grouped housing schemes.
- A new and updated development plan is needed
- Softcare should partner with existing player (s).
- It is recommended that the work on identifying potentially suitable partners takes place as soon as possible.
- A viable product development plan with stage pricing showing share of risk and return, expected market take-up and growth, and predicted cash flow will also be required

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Contacts with potential industrial partners

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Selection Criteria

- Personal chemistry between potential partners.
- Complementary – products, capacity in production, design distribution, training, sales, matching culture, willingness to trade and cooperate, ability to offer financial support, acceptable agreement terms.
- Does the company / organisation already work with third party R & D organisations?
- Is the company likely to be interested in participating as an unpaid partner in the Softcare consortium, on the basis that it will then become the vehicle for Softcare solution launch / post-product launch?
- Has any one within the consortium worked with the company before? Can we expect to work on the basis of mutual trust and respect?

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Areas for collaboration

Integration of Softcare system within:

- Telecare service value chain
- Home / Nursing home
- Relatives / carers
- Emergency care centre (CRM systems)

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Task 1.5: Contact with potential industrial partners

Company	Y / N	Progress
Argyll	Y	NDA sent and signed; Detailed collaboration under way
Jontek	Y	NDA sent and signed; collaboration possible post proof of concept
Mobidarm	?	Meeting held, but no immediate interest
Tunstall	N	Contact made, some possible interest would be handled from German office
Tynetec	N	Interested, but no available capacity
Caretech	N	Interested, but no available capacity

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Objectives of collaboration

- Check that the approach to prototyping / proof of concept will actually be considered significant by the likely chosen channel to market.
- Share technical information with chosen collaborators
- Ease eventual adoption of the solution tested as part of channel partner portfolio.
- Protect Intellectual Property created by Softcare; generate new IP.

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Contractual framework for collaboration

- An NDA developed to permit information sharing with specific named collaborators
- No consortium (AAL funding) to be available, but Softcare partners may use existing efforts in partnership.
- Distinguishes:
  - background – no information / IPR rights granted
  - foreground created specifically through collaboration with named partner – equal rights / share of IPR
  - foreground created within the Softcare consortium - – no information / IPR rights granted

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Planning for exploitation

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Preconditions for launch: Yes to the following:

- The solution clearly addresses a known niche within the telehealthcare market
- We know exactly how the needs of target end users in this niche will really be addressed.
- We know the exact limitations of existing products and players in the market.
- We have links in place with other organisations where our own specialist knowledge is sparse.
- We have developed plans to use support agencies to overcome obstacles to market entry like obtaining regulatory approvals.
- We intend to pilot the concept with focus groups and representative organisations before committing to large scale expenditure.

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Where we need to be by project end:

Supporting material will be required to demonstrate that the Softcare solution:

- uses reliable sensor system/components
- complies with applicable standards / regulations
- integrates with the partners portfolio
- complements existing sensors and alarms
- meets a use case with an acceptable business case

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Go to Market Scoping

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Output from Softcare

- Softcare will deliver a working **prototype** (only)
- Solution to be based on wrist-worn device to capture / analyse location, falls, ? heart-rate
- Innovation in two main areas:
  - Monitoring of and communication of an elderly probably frail, person within their own home, in a sheltered or nursing home using wireless not hardwired systems
  - Same device monitoring outside the home environment, using mobile tracking technology
- Softcare project does not include any funding for or any firm commitment from Softcare consortium members to take the deliverables from the Softcare project to market.

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Service components for commercial service based on Softcare - 1

- *Mobile wrist-worn device (indoors and outdoors)*: sensors for motion, fall-detection and heart-rate, required communications – a ZigBee based wireless transmitter and GPS / GPRS functionality when used outside the home. Such components could be developed and produced by MeshWorks Wireless.
- *Static (indoor) node:* master static node to receive ZigBee messages from the wrist-worn device and transmit them via GPRS to a web-service. Also built-in microphone and loudspeaker. Possibility of a static outdoor node to extend the range of the Zigbee network into the garden. Such components could be developed and produced by MeshWorks Wireless.
- *Installation and Configuration:* A trained team for installation and configuration of the mobile and static devices, including commissioning the Zigbee network, connectivity to internet, hard wiring when required and GPRS / GPS set up. A third-party installation team is needed.

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Service components for commercial service based on Softcare - 1

- *24/7/365 Data-centre*: to take data from the web-service for storage and analysis. This analysis would produce reporting data and alert data to be sent via a web-service to a third party, such as a home warden, carer, family member, health or social care professional. This requires 100% availability hosted solution with appropriate fail-over backup and high-bandwidth communications would be contracted at a monthly rate. HealthSystems may consider this.
- *Service / Call Centre:* to be run by the third party for escalating alerts according to pre-agreed procedures and building reports of individual patient/relative activity. Argyll Telecom's Archangel service or other similar service provider (e.g. Jontek, Tynetek, Tunstall) for a monthly subscription rate per patient/resident.
- *Web access* by professional carers and authorised patient/resident relatives to reports. This could be provided by Argyll Telecom's Archangel service or other similar service provider (e.g. Jontek, Tynetek, Tunstall) for a monthly subscription rate per patient/resident.

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Go-to-market essentials

At this early stage, at least the following would be needed to take Softcare to market:

- Solution design and trialling
- Product approval and conformance testing
- Market Research
- Sales and marketing
- Operational costs for running the business

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Quantifying costs for market launch

The amount of cash required will be a function of:

- How many countries to launch in
- What is the target user group, # end users, and what are their needs
- How these needs would be satisfied profitably using the solution
- What is the channel strategy – i.e. direct to public sector, direct to consumer via third party etc.

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Illustrative Investment requirement for Go-to-Market

At this early stage, ***one off go-to-market costs could total around €4.5M***.

In addition, annual operational costs of €4-8M per annum could be expected..

Go to Market component	Comment	Range: cash drain over 5 years
One off costs		
Mobile wrist-worn device (indoors and outdoors): *Static (indoor) node:*	To obtain reasonable pricing from a manufacturer, 100,000 units could be a key threshold – total of 3 units * €15 = €45 per solution set to be manufactured could be a target	€2-5M
Installation and Configuration:	Little upfront expenditure with the third party installer seems likely to be needed, other than development of service and installation manuals and staff training	€100-200k
24/7/365 Data-centre:	Purchase of hardware, development of robust certified software solution would be needed	€200-400k
Service / Call Centre:	Charge of €18 per month per user seems likely. Some initial set-up expenditure would be needed	€100-200k
Web access		
Solution design and trialling	Taking the Softcare prototype as a starting point, an overall solution capable of achieving targeted costs, revenues and profitability will need to be developed and inform subsequent work	€100-200k
Product approval and conformance testing	A range of national and international standards need to be complied with, and the solution set will need to demonstrate ongoing compliance	€100-200k
Market Research	To identify target customer groups and from this inform overall solution design	€75k
Sales and marketing	Initial sales and marketing set up costs	€100-200k
Recurring costs		
Operational costs for running the business	Assume costs are 50% of cumulative revenues achieved over 5 years	€20-40M or €4-8M per annum

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Revenue Potential

A business with 5 year cumulative revenues in excess of €60M is conceivable:

	Year 1	*Year 2*	*Year 3*	*Year 4*	*Year 5*	*Cumulative*
# of end-users	100	15000	30,000	75000	100000	
Revenues in €k						
Hardware purchase	3	450	900	2250	3000	6603
Service charges		2700	7425	18169	31627	59920
Total	*3*	*3150*	*8325*	*20419*	*34627*	*66523*

Key issues:

- Which organisations would invest and be involved in go to market?
- Nature and availability of investment funding
- Would the service be capable of attracting 100,000 end users at targeted price?
- Is it possible to deliver product and install it for €200 per unit?
- Is it possible to deliver service for € 30 per month service charge?

3. Final presentation

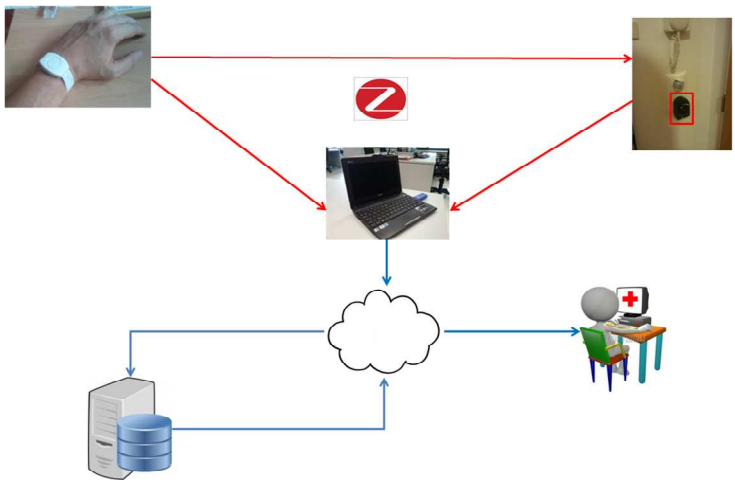
London, April 2013

5 partners in the
AAL funded Softcare project:
-HS
-CRIC
-FRK
-CEIT-RALTEC
-MWW
The project started in November 2009.

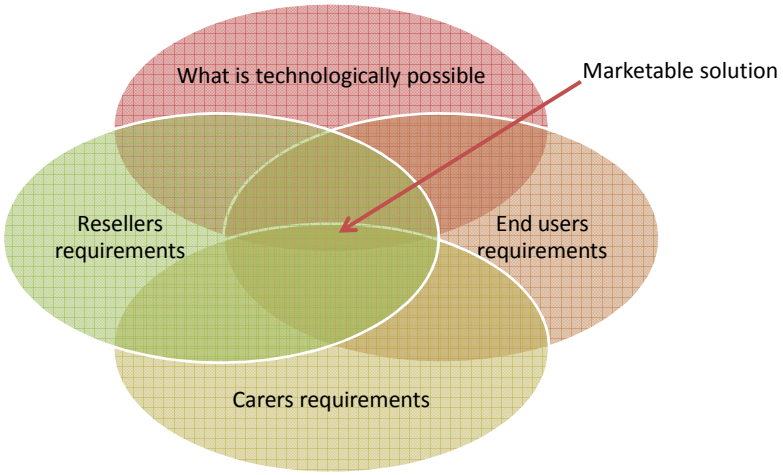
Features

- **Automatic fall detection:** a call to the carer is automatically launched if a fall is detected.
- **Panic button:** an immediate communication towards carers is enabled if the bracelet's button is pressed by the user.
- **Activity recognition:** some activities of daily leaving (ADLs) can be recognized using leading pattern recognition techniques. Currently, the system is able to distinguish between: walk, rest, cook and eat.
- **User activity level assessment:** the different activity levels can be inferred from the motion analysis. For instance, the classification can be: high, medium, low or no-activity.
- **User location:** the SOFTCARE system is capable to locate the user with room precision.

SOFTCARE



SOFTCARE priorities



SOFTCARE priorities

- **Easy deployment:** one static node is plugged in each room, the bracelet is worn on the user's wrist and the gateway of the SOFTCARE application is activated, that's it!
- **User acceptance:** the bracelet is small, light and well designed so it does not stigmatize elderly people's fragility. Additionally, the system does not cause privacy concerns as only acceleration samples from the user arm are sent to the gateway.
- **Ubiquity:** as the bracelet is comfortable, it can be worn while performing all daily activities (a water proof concept is planned for future releases).
- **High reliability:** artificial intelligence algorithms are implemented on the gateway where the final decisions are made. Both fall detection reliability and false alarms avoidance significantly increase with respect to those solutions which perform the fall/no fall decisions within the device worn by the user.

Hardware components

- **The bracelet:** light and comfortable accelerometry-based device incorporating a panic button.
- **The static nodes:** small devices plugged at the user's home (one per room) acting as signal repeater and allowing the user location when indoors.
- **The gateway:** device acting as network sink, being the '*decision maker'* that establishes the voice communication channel towards carers if a hazardous situation is detected. For the current prototype, a notebook is used for this purpose.

Software components

- **Database:** the SOFTCARE gateways use a web service for sending data, this data is kept in a database after being processed
- **Web Application:** A web interface is used by carers for accessing the system, checking user status, getting reports, etc.
- **VoIP:** the system used in the trials incorporated a module based on Skype for allowing VoIP communication

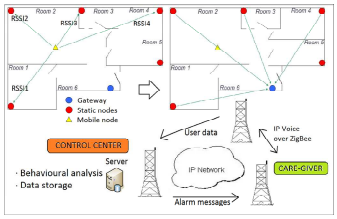
System training

The system requires the following steps:

- Place static nodes, one per room.
- Location training: it requires moving around each room wearing the bracelet (around 4 minutes per room)
- Activity training: to execute activities to be recognized wearing the bracelet (cooking, eating, resting and walking) for 3, 4 minutes each.

Location

SOFTCARE locates the user at room level



Indoors at room level.
- Activity.
- Dangerous situations
- Voice response
- Integration with other devices

Activity analysis

Two different ways of classifying activities:

Classifying daily activities:
walking,
eating,
cooking,
resting,
Based on: accelerometer measures + indoors location information. Single movements/gestures + statistical analysis.

Classifying activity levels:
High-Medium-Low-No Activity levels.
No training required.

Fall detection

Aim: fall detection with minimum false alarms.

Two steps:

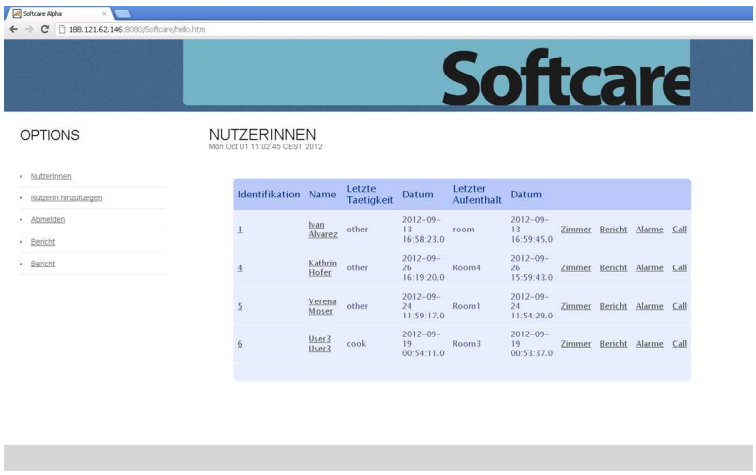
1. Peak based detection: send acceleration stream to server

2. Server side: compare event with database. Algorithm dimensional reduction + combination of automatically and manually chosen features.

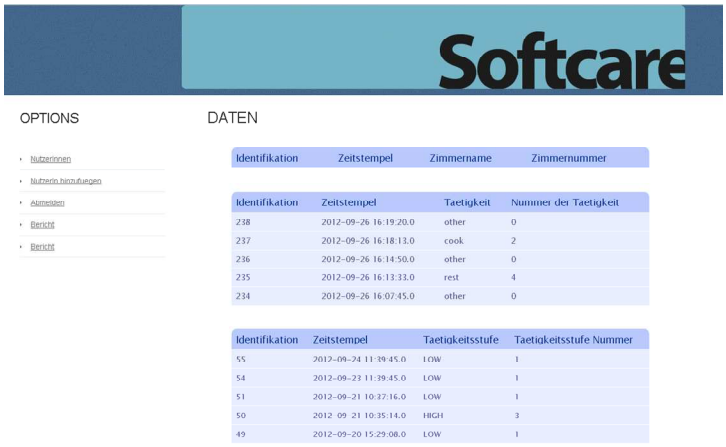
False alarms:

When fall is detected, filters discard false alarms: activity based, voice communication and user initiated.

Checking users

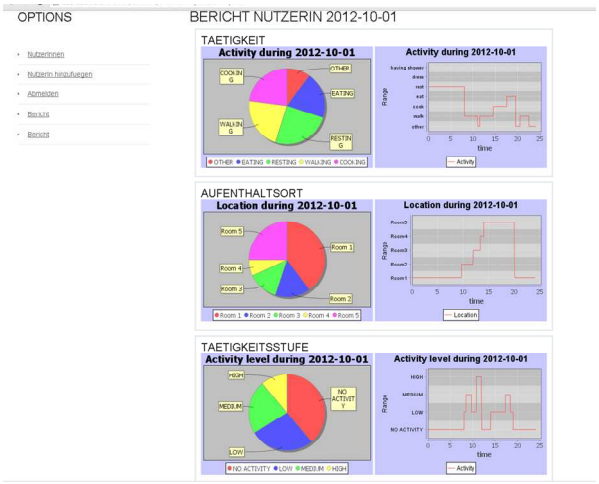


Checking activity



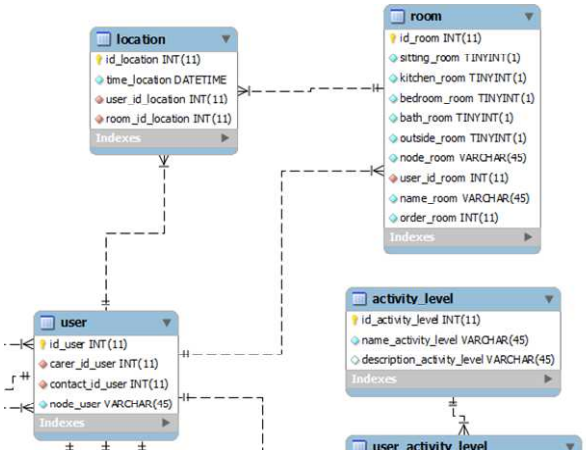
Checking alarms

Getting daily reports

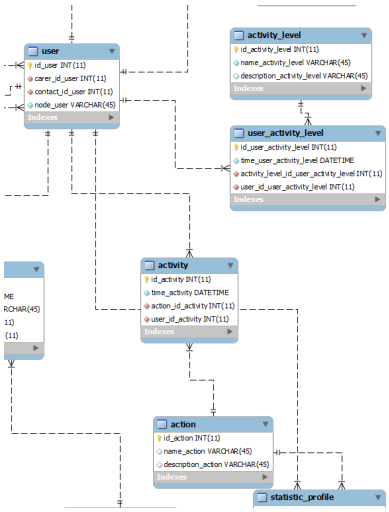


Getting long term reports

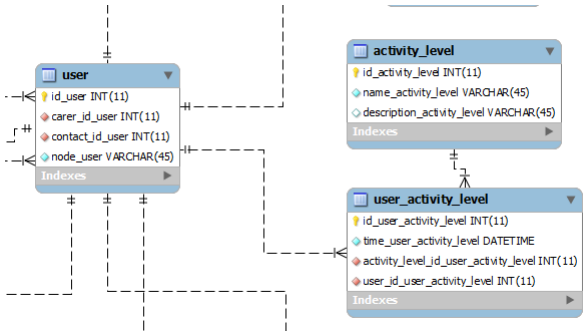
Location information



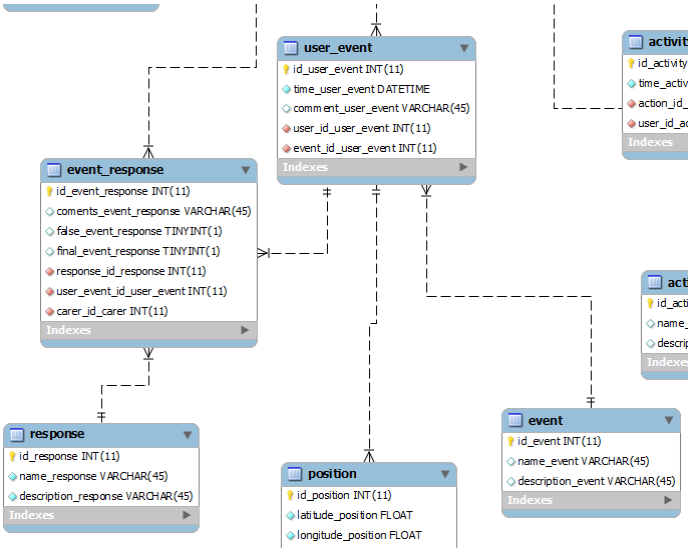
Activity information



Activity level information



Alarms information



Evaluation

- **Fall detection:** no real falls during the trials. Only 3 false alarms during the trials (4 users 1 month) and all of these in a short period and with the same user. Results with simulated falls are around 94% of accuracy.
- **Location:** Fails when trying to distinguish different areas in the same room.
- **Activity:** Fine tuning required. Not all activities might be interesting
- **Activity Level:** worked fine. Provided relevant outputs (correlated with user feedback)