Carelink

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EDITORIAL

The Carelink project phase has drawn to a close. The project partnership involved 6 partners from 3 countries (Ireland, Belgium, Portugal and Switzerland). A mix of Research Groups, SMEs and Not-for-profit entities joined forces to develop a smart, adaptive and low-cost solution for positively managing the wandering of people with dementia. This newsletter provides an opportunity to reflect on some of the key learnings and outcomes from this collaboration. From a development perspective, UNINOVA has pioneered dynamic energy management and flexible use of communication and localization protocols to deliver improved runtime in a variety of contexts compared with existing products. Regarding software, TSSG, supported by OpenSky Data has advanced location tracking through a microservices based platform. The approach lays the foundations for intelligent location tracking, interoperability with a range of devices and the possibility to add other services. Guided by the work of CREAGY in business and exploitation exploration and U-Sentric & Akademie Berlingen in identifying and understanding the needs of end users, the team developed an understanding of the complex domain that is dementia. People with Dementia and their carers have a variety of needs to resolve and each situation is different. Wandering is just one of many considerations which will affect part of the population. Any solution must fit with preferences, lifestyle and those other needs. A key learning from user research was the need to focus on ability and to enable where possible. The team has endeavoured to reflect these learnings throughout its iterative development. Unfortunately, the pandemic has prevented field trials in certain locations. However, the team finishes the project phase with the belief that work to date has yielded valuable prototypes and plans are in place to advance these towards a market-ready proposition.

PARTNER REFLECTIONS

CREAGY

Following the Carelink project, CREAGY is about to build a new AAL product with a wider range of software services to support elderly people. This service has its focus on people living alone to tackle the daily needs (e.g. taking prescribed medications, video calling with caregiver, heart rate monitoring, etc.). As a basis for this new marketable software product, CREAGY is using various results of previous AAL projects. CREAGY will build the new solution on some software components, but even more on the experience gained during the work with end-users and other stakeholders in the aging sector.

CREAGY still sees a great need for innovative technology development and is convinced, that there is a common misperception that older people struggle with technology. As a result, most new technology developments are targeted at younger customers. However, the average age of the population in Europe is steadily increasing. The difference between technology use by the young and old has a relatively simple explanation; almost all new technology is designed for use by younger people. Designers and manufacturers are deliberately ignoring the over-65s when creating new products and services. Quite logically, older people often choose not to use products that have nothing to offer them. That is a lost opportunity. Because many older persons would benefit from modern technology. With a new product portfolio, we will encourage frail older people in self-management and social interactions and even letting the user become a caregiver itself.

The innovative ideas and presented results of TSSG on the software side and UNINOVA on hardware devices encourages the belief, that Carelink has the potential of a market success. That's why we are closely watching the ongoing Carelink developments and would be happy to integrate a successful Carelink device or service in our solution.

UNINOVA had the lead in the hardware development and prototyping for the Carelink localisation solution.

Right from the start, the project faced multiple challenges, that were common with similar concept solutions for wandering localisation, namely the very important need to extend as much as possible the battery autonomy time, as well as having the smallest form factor possible (in order to extend wearable's integration possibilities) and, at the same time, maintain a robust and resilient system, no matter the usage conditions. Existing solutions either lacked real-time tracking or did not have extended battery autonomy (usually maxed out at 2 days). The usability and product appeal were also reported issues, that prevented mass adoption, due to the stigmatisation associated with wearing tracking devices. On top of these problems, most solutions at the time were not able to maintain constant tracking due to signal coverage conditions, that can change based on the toponomy of the location, signal availability and network deployments.

After extensive research for available technologies and hardware solutions, two novelty development boards were chosen to begin prototyping and testing as solutions within Carelink: the Sodaq R412M and the Pycom FyPy. The main goal of using two different prototypes was to test both scenarios, where usability and wearable integration was more relevant and another where resilience and robustness could be highlighted.

Improved iterations of the prototypes were developed, expanding the functionalities and capabilities available to be used in real-life trial scenarios.

	Sodaq Insole	Pycom Insole (for demo only)	Pycom Belt Box	Sodaq Belt Box
3D CAD renders				
Exposed hardware housing				
Enclosed prototypes				

In order to maximize the usage of the battery, a solution of adaptable energy profiles was envisioned. Each energy profile dynamically changes the actuation of the multiple components of the hardware (sensors, communication radios, localisation modules, etc), depending on the conditions of utilization of the device and the profile of the user (the type and safety of the current location, the time of the day, the remaining battery capacity, the available communication networks, and if it is accompanied by a carer).

By maximizing the correlation of the external conditions to the appropriate usage of the components, it is possible to extend the autonomy of the device and at the same time increase the robustness and resilience of the tracking solution. To maintain a critical, high availability localisation solution, it was required to use multiple technologies for both the communications and localisation techniques.

For the communications, the use of cutting-edge, low-power, IoT technologies such as Narrow-Band IoT (also known as LTE-NB), LoRa, Bluetooth Low Energy (BLE) and Wi-Fi, resulted in a distinct range of available networks, capable of coverage in different topology environments: urban, rural, outside, and indoor. Likewise, for the localisation, besides the Global Navigation Satellite System (GNSS) modules (compatible with the GPS, GALILEO, and GLONASS constellations), a multilateration approach was also deployed with the resource of the LoRa network, as well as the use of assisted location services (using available Wi-Fi Access Point's data).

If the device loses coverage from a given technology in use, it is capable of independently falling-back to a better suited one, thus ensuring constant availability.

Overall, mitigation of (almost) all disruptive influences and behaviours of hardware operations, required continuous testing in real conditions, and real-time iteration and maintenance of the hardware operations (such as implementing LoRa as a fall-back method for areas with poor NB-IoT and GPS coverage).

The results of the work developed enhanced the total prototype autonomy time by a factor of 4, when compared to current active tracking devices on the market (up to one/two weeks between charges, depending on the intensity of usage). Additionally, the use of multiple communication and localization technologies mitigates the signal coverage issues, identified by the different topologies of utilization (indoor-outdoor, rural-urban), thus extending the availability of the Carelink tracking solution.

OpenSky: Carelink Completion Drives a New Starting Point

For the duration of the Carelink project, the focus was on what we needed to do to complete tasks, achieve goals, find solutions and innovate, etc. Now, as the project has been successfully completed, we share with you what the project has achieved as well as what it has meant for us in OpenSky.

In 2014, a decade after the company's official incorporation, when some significant battles for sustainability had been won, one question that arose was: what more can we do in the next decade? One part of the answer was the importance of bringing a dedicated research, development and innovation function to the organisation. While innovation is implicitly an essential variable in any ICT company at any given time, our goal was to fully integrate this function within the structure of the entire organisation.

Research for the sake of research does not make much sense in today's world and for good reasons. This is valid even for the organisations that have been created specifically for research. Without denying the crucial importance of applied research, fundamental research itself is challenging to perform. OpenSky being a typical "for-profit" company, the initial integration of research project activities, with other departments in the organisation, raised a set of specific challenges and risks which were new to all involved, however there has been great importance, benefit and results in integrating all other functions of the organisation with our recently developed research projects division.

As GovTech specialists and members of the EU, OpenSky are compelled and obliged to deliver robust integrated solutions to the public sector, that meet the digitally minded demands of the EU citizens of today. For the EU public sector stakeholders, OpenSky aim to provide interoperable communication solutions that enable public and private agencies to achieve seamless connectivity, even in the most challenging of environments.

Carelink was an important EU funded project in OpenSky and its success was crucial for further business model innovations. While working on Carelink, we planned and created the Research Projects Division, a division setup within OpenSky dedicated to Innovation. It's through this, which we have expanded our networking activities, our research ideas and have begun to build new ways of delivering digital through new technologies. We became involved in partnerships/consortia for projects in H2020, IMI - Innovative Medicines Initiative, ISA² - Interoperability solutions for public administrations, businesses and citizens, EBSI – European Blockchain Services Infrastructure, etc. We have now a significantly improved approach toward the 2021-2027 EU MFF.

Carelink has played an essential role in all of these for OpenSky. The company is grateful for the opportunity to be part of a strong consortium, of a group of excellent professionals, working to a project dedicated to people who need our support. Thank you to everyone involved and OpenSky is looking forward to Horizon Europe.

TSSG

TSSG led the software development effort for the Carelink platform. A microservices approach has been used to deliver the 7 key platform services. Synchronous and asynchronous communication between the services is achieved via message bus (Apache Kafka) and REST protocols.
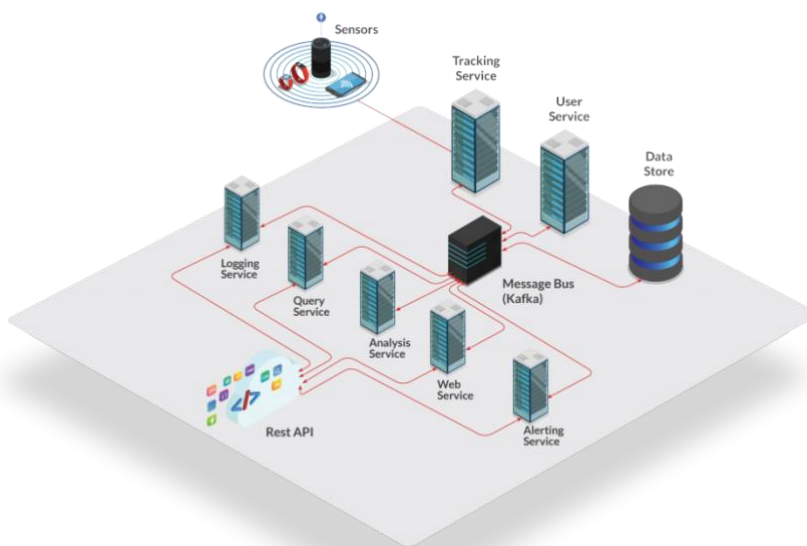
Services are containerised using docker and orchestrated with Kubernetes. The key services include;

- Web service (user interface)
- User service enabling registration, authentication/ authorisation, Retrieve/ update career details, retrieve/ update PWD details
- Tracking service which identifies if a mobile PWD is in a safe zone
- Analysis service for safe zone detection. Additional pattern analysis and route prediction investigations and testing have yielded promising results with some further work needed.
- Alerting service to trigger SMS notifications to carers. These notifications are managed using external service Twilio
- Proxy service
- Logging service

The microservices based architecture ensure interoperability with multiple sensors and devices. While the pandemic prevented full testing of the Carelink prototype, the TSSG team has been involved market outreach efforts and based on insights from these conversations and research, feels that the Carelink software offers key points of difference compared with existing solutions in the market including the aforementioned interoperability which allows for the onboarding of different devices and services. Furthermore, the location intelligence is promising both in terms of facilitating a different approach to care within the ambient assisted living context as well as in terms of applicability to further domains. The team is excited to work with Carelink partner and hardware developer UNINOVA on possible joint exploitation of the Carelink offering and is separately investigating other options for further developing and commercializing the software assets. For more information please contact info@carelink-aal.org.

U-Sentric & Akademie Berlingen (AKABER)

U-Sentric and Akademie Berlingen were focusing on the creation of a future-proof concept for people with dementia by gathering insights in the needs and wants of these people and their (informal) caregivers, and conducting pre-tests and field trials where possible. The goal was to come with an adaptive solution that monitors people with dementia and that helps bring a positive outcome to wandering events. A research approach was developed that could be replicated across countries and that reflected ethical and empathic considerations necessary when engaging with vulnerable groups. The key takeaway is approach people with dementia 'differently'. Some key pointers that guided user research include;

- Go as a human being; be transparent about your goals but be relatable,
- Always treat people with dementia as adults; involve participants directly and do not belittle them,
- Use personas as a tool for projection; stories with profiles can get the conversation started,
- Make sure to get consent,
- Bring a gift to thank them for participation.

U-Sentric acquired more in-depth expertise within the domain of health, more specifically running interviews with Alzheimer's groups or vulnerable communities and intend to use this expertise to build new cases and explore new cases in the health domain.

Regarding field trials, Akademie Berlingen developed testing and trial protocols. The field trials were designed to test 2 x different types of hardware as well as the Carelink platform. A key focus was to assess usability, accessibility and user satisfaction. Well recognized methodologies such as the Systems Usability Scale and the Questionnaire on Technology Acceptance based on Unified Theory of Acceptance and Use of Technology (UTAUT). Support for the participants before and during the trial included an initial face-to-face meeting, clear information on start/ end dates, tasks and usage guidelines, regular contact and completion interviews. The latter had to be conducted virtually as a result of the coronavirus pandemic.

Through participation in Carelink as the responsible agent for testing, AKABER has got an excellent overview and up-to-date information about the market of tracking devices and a deep insight of what is required and accepted by their target groups. This knowledge will be used by AKABER as a new offering for their customers as an independent consultant for geo fencing- and localising-systems and services for people with dementia and their care givers.