Newsletter
September 2019 - October 2019

VICINITY 2020

"Interoperability as a Service" – Connecting IoT infrastructures and smart objects

GoTo

Editorial - VICINITY at the final - but not last - sprint

Dear Partners & Friends,

Our VICINITY project is currently in its final stage. The projects is funded by the EC to create an initial implementation, and to highlight its capability via a number of use cases.
We are very close to achieving this.
But, to be clear, this will not be the last stage - VICINITY is ready to use in our daily businesses.

We are in transition from being grant-funded to commercial exploitation and use.
This newsletter presents news of progress in that direction.
We have had lots of action that shows applicability and quality of the VICINITY platform.

Prof. Dr. Christoph Grimm

Coordinator of VICINITY project
Technische Universität Kaiserslautern

This includes two hackathons (with winners to report!) and several other events where we demonstrated VICINITY.

Furthermore, the 2nd Open Call is running successfully, bringing four new partners and users onto the VICINITY platform.

Last but not least, we are receiving evaluation results from our own four pilot sites.

We hope you will get a very good impression of the merits of VICINITY that are summarized in this newsletter.

And remember there is more to come.

This will not be the last news from VICINITY.

Best wishes *Christoph*

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Latest News and Upcoming events

Latest news

- AAU presented VICINITY in a keynote speech of the Electric Power and Power Electronics Conference, 3rd October 2019, Växjö, Sweden.
- ENERC had a session - Ignite Data Marketplaces in the AIOTI signature event "IoT Through the Looking Glass", 8th October 2019, Brussels, Belgium.
- ATOS, UPM, and ENERC participated in IoT Digital Workshop and a hackathon was held with VICINITY participation on 18th October 2019, Salamanca, Spain.
- ATOS, UNIKL, and UPM participated and presented VICINITY in ETSI IoT Week 2019, 21st - 25th October 2019, Sophia Antipolis, France.
- ETSI has just published a white paper ETSI TR 103 535 - SmartM2M; Guidelines for using semantic interoperability in the industry based on contributions from H2020 projects MONICA, Activage, Inter-IoT, BigIoT, and VICINITY on 23rd October 2019.
- The VICINITY YouTube channel is available at https://www.youtube.com/channel/UC7TNz7JosAqTWIR2-oq5w3A.

Upcoming events

- The next General Assembly (GA) of VICINITY will take place in Portugal next 28th and 29th November. Hosted by partner ENERCOUTIM with the support of CCDR – the Algarve regional policy authority. The two-day meeting will take place at the CCDR auditorium in the centre of Faro, the capital of Algarve. The agenda features the meeting itself and a visit to one of four VICINITY pilot sites: Martim Longo, also located in the Algarve region. The Enercoutim team will host the event and share insight at the pilot locations. Besides discussing progress and coordinating the final period of the project including planning the February review meeting, a workshop with regional stakeholders is being

organised. The Algarve region is positioning its ecosystem for innovation and development with specialisation in the hospitality sector, sea economy, sustainable agriculture and energy.

The next General Assembly (GA) of VICINITY will take place in Portugal.

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VICINTIY participated actively in the IoT Week 2019 held in Aarhus, Denmark

VICINITY presented lectures in the following three sessions during the IoT Week on 17th of June 2019

• Session 1 - VICINITY, an IoT Platform for the Ultimate Privacy 11:00 AM - 12:30 PM.

Privacy in the IoT has becoming a growing concern due to possible loss of trust of users, as a potential risk to success. This session gave an overview of the VICINITY IoT platform that is open, free, and that specifically addresses SME and users with privacy concerns. The session gave a broad overview of the VICINITY platform, starting with its general objectives and unique selling points, the P2P architecture, semantic discovery and interoperability, and an outlook on advanced and upcoming microservices that further strengthen privacy in the IoT, including abstraction services and homomorphic encryption services.

• Session 2 - Privacy in the IoT and VICINITY - Legal Background, Standards, Business Models 2:00 PM- 3:30 PM.

Privacy in the IoT is driven by the wish of consumers, enabled (or not) by standards, enforced by law, and can be a threat for business models. This session consisted of presentations that gave an introduction to the topic, introduced business models for IoT platforms that do not necessarily rely on exploiting the user's personal data, and showed standards and solutions that pave the path towards an IoT with business models that do not rely on disclosing personal data.

• Session 3 - Privacy in the IoT and VICINITY - Use Case Specific Challenges and Legal 4:00 PM - 5:30 PM.

Security and privacy are major concerns for the use and acceptance of the IoT, especially in cases where private, non-aggregated data are concerned. The use of the VICINITY Platform combined with secure storage and authorized data transactions respecting GDPR regulations, aims to address privacy challenges of applications. To ensure that the IoT users are fully aware to whom, for which data and what purpose, they give consent to, is the first step for global acceptance IoT applications. Privacy-by-design principles are offered by VICINITY Platform in terms of IoT devices and services privacy agreements (Contracts), strengthened by security features as encryption and use of the XMPP protocol for communications, which is of great importance in today's eHealth, smart cities and energy IoT applications.

IoT Week 2019 Hackathon

- 24 Hours Hackathon
- An Overall prize of 25000 DKK (3,333.33 Euro)
- Two Category Awards
- Three Special Mention Awards

- More than 60 participants
- 11 teams, Food, Drinks and a lot of fun!

IoTWeek 2019.

The IoT week hackathon was hosted at Musikhuset in Aarhus, Denmark, with more than 60 registered participants.

The IoT Week hackathon competition attracted students, developers, designers, entrepreneurs and general public. Their aim was to learn with practical implementation how IoT technologies are evolving. It also gave them insight into new emerging technologies in the industrial market.

The hackathon focused on topics within the United Nations Sustainable Goals (UNSG):

- 03 Good Health and Well-being
- 06 Clear Water and Sanitation
- 11 Sustainable Cities and Communities
- 13 Climate Action

Two categories for the competition were created:

- Category 1 sponsored by GRUNDFOS
- Category 2 sponsored by IoT-LSP (Large-Scale Pilots) Initiative with lead projects like ACTIVAGE, SYNCHRONICITY and VICINITY

11 teams were created and with a standard number of 4 members on each team. The participants carried out 24hrs of brainstorming, coding, engineering and imagining how the world, following UN Sustainable Goals, could be better equipped for future generations by presenting new IoT ideas and solutions. Participants also had access to IoT hardware thanks to SYSTEMATIC, a hardware provider company that also sponsored the hackathon.

VICINITY team which supports the participants.

This year the winner team of the hackathon was the EFFECTIVE CRICKETS team that won the 25000 DKK (3,333.33 Euro). The participants used the VICINITY platform.

VICINITY team supporting the participants.

The EFFECTIVE CRICKETS team proposed an innovative disruptive-idea to reduce carbon footprint and at the same time save food waste by reducing the consumption of veal and instead consume crickets that, according with scientific studies, contain the same or even more protein and calories. In terms of IoT technology the objective was to detect the readiness to be consumed. They prototyped and demonstrated an image recognition system that can detect and count not only the number of crickets in a specific area but also the size and the maturity level by their colour. Sensors and actuators will act as indicators for farmers for those crickets that are ready to be collected for consumption.

Two more awards were given away in the hackathon, in the following two categories.

The GRUNDFOS award (category 1) went to the GREEN SPOT Team addressing UNSG-category 03 providing an innovative water and sanitation solution. The LSP-Projects award (Category 2) went to the team Urban Air who addressed the UNSG 03 looking at reusing technologies from ACTIVAGE project.

Three more special-mention awards were given away in the closing ceremony of the IoT Week hackathon.

The team AQUARY addressing UNSG-06 was awarded with the best idea award. The team GIW looking at UNSG-13 received the Best Innovation Award. The team Footprint-4-The-Day addressed UNSG-13 using VICINITY project tools and received the Best Business Idea award.

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Interview with Nissatech

Why is important for you to address the VICINITY functionality "enable sharing of data at semantic level"?
Interpretation of data received from different sensors is related to a proper understanding of the meaning (semantics) of the signals. This is the only way for ensuring that the situations, which are described through this sensing, will be interpreted in most appropriate way.

Why is Digital Sovereignty By Design important for you and your customers?
Personal data has an extreme value for a user (trainee) in the fitness and health domain, since it can be used for analysing and improving the performances. However, it can be easily misused, if obtained by someone who wants to check the general health status of a person.

How the GDPR is impacting your business and how is VICINITY helping you to apply it?
GDPR is a basic requirement for the fitness and health domain, we are active in. VICINITY provides a basic infrastructure for realizing some of the technical requirements related to the storage and processing of personal data in a way that meets this requirement.

What is your opinion of the concept that the edge-computing approach with P2P yields higher scalability and dependability features? Why is it important? How are these functionalities helping you?
Wearables can be treated as extreme edge. Due to their scarce resources, it is very important to enable an efficient processing on the edge. This includes different types of anomaly detection.
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Interview with Sensinov

Why is important for you to address the VICINITY functionality "enable sharing of data at semantic level"?
Fault Detection and Isolation for IoT field devices in smart buildings as a Value Added Service (F2I-VAS) is proposed. We are developing a machine-learning service based on determining trend vectors and comparing such vectors with longer-term historical data using VICINITY nodes. Semantic interoperability is crucial to our project since we perform translation from the VICINITY data model (thing description) to the IBM Watson data model regardless of data source. Without VICINITY, we will have to develop an adapter for each integrated smart building / technology.

Why is Digital Sovereignty By Design important for you and your customers?
Digital sovereignty is a critical aspect for the lifecycle of any project dealing with data. We take this aspect very seriously and adhere to country and regional regulations (GDPR). We use the data only for training the algorithms and for the purpose of detecting faults. There is no storage nor preservation of the VICINITY data after the processing and insights generation. VICINITY Infrastructure owners have the complete control of their data.

How is the GDPR impacting your business and how is VICINITY helping you to apply it?

In the context of F2I-VAS project, we use data sets pertaining to Smart Building: air, humidity, temperature, light quality, CO_2, etc. Our proposal does not deal with personal data. Regulation such as free flow of (non-personal) data is applied in the context of the digital single market. We ensure that all data is anonymized.

What is your opinion of the concept that the edge-computing approach with P2P yields higher scalability and dependability features? Why is it important? How are these functionalities helping you?

Hybrid solutions (regrouping edge and cloud computing) are ideal for allowing for stepwise migration to high volume data analytics at a pace in line with CapEx and OpEx constraints of organisations. Some smart building setups require data to remain local in the building (defence, strategic industries, etc.), hence the relevance of data processing at edge level. There are other advantages of hybrid solutions such as: resiliency provided by the cloud as backup in case of failures in edge processing capabilities.

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Interview with VizLore Labs Foundation (VLF)

Why is important for you to address the VICINITY functionality "enable sharing of data at semantic level"?

VizLore Labs operates its own IoT platform as well as Blockchain as a Service solution. Both of these solutions require a high level of interoperability with 3rd party systems and services. This is why VizLore Labs Foundation (VLF) has always implemented standards and best practices for data description (semantics) in the IoT domain. Our IoT and Blockchain services include: Smart Access Control, Indoor navigation, Asset Tracking, and the ChainRider API. These are incorporated as fully automated workflows with minimal end-user involvement. Semantic level interoperability as provided by VICINITY plays the key role for successful implementation of these services by facilitating M2M interactions and API service integrations.

Why is Digital Sovereignty By Design important for you and your customers?

Digital sovereignty enables us as platform and service providers for businesses and end users to focus on added values derived from information which is agreed and provided by the stakeholders.

How is the GDPR impacting your business and how is VICINITY helping you to apply it?

VLF applies GDPR compliance guidelines and privacy by design paradigm for all digital products. We acknowledge the value of VICINITY approach/architecture where coordinated P2P communication between entities within the VICINITY ecosystem ensures that the data regarding on-boarded services and exposed things are not stored in a centralized repository. Additionally, the contract system for services (requests for services with access levels) which is part of the Neighbourhood manager gives additional control over who/what has access to service/devices integrated within the VICINITY ecosystem.

What is your opinion of the concept that the edge-computing approach with P2P yields higher scalability and dependability features? Why is it important? How are these functionalities helping you?

VLF's IoT platform integrates an edge-computing solution based on our family of IoT controllers. These controllers are both communication/protocol bridges for IoT systems and devices as well as edge-computing nodes and are capable of performing real-time context-aware decision-making; and smart-actuation. In the backbone of VizLore's IoT platform is the concept of soft sensors. Soft sensors are software modules which combine data from multiple data sources in order to provide contextual and actionable data. Our edge controllers are designed to be compatible with layer 1 (data sources are primitive sensors) and layer 2 soft sensors (data sources are layer 1 soft sensors) thus leveraging the edge-computing approach for proactive, context-aware, real-time actuation and offloading our cloud services.

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ubiwhere

Why is important for you to address the VICINITY functionality "enable sharing of data at semantic level"?

Sharing of data at the semantic level is crucial for Ubiwhere's flagship products (urbanplatform.com and smartlamppost.com platform, as key examples). In order to intelligently aggregate and process a vast amount of data from heterogeneous sources and devices following different data models and communication protocols, a large amount of effort goes to data standardization and harmonization before we can use it with, for example, our user-facing applications and analytics.

Why is Digital Sovereignty By Design important for you and your customers?

Privacy and sovereignty by design are of utmost importance. Consumers are becoming increasingly aware of the negative impact the lack of such may have. Ubiwhere's applications whose targeted end-users range from regular citizens, private companies and municipalities, are always designed having digital sovereignty in mind for the ground up. When sharing Ubiwhere's acquired data with other entities, fine-grained access control and data ownership are always well structured in our services. In essence, it is very important for Ubiwhere's commercial activities.

How is the GDPR impacting your business and how is VICINITY helping you to apply it?

GDPR concerns have not yet been properly addressed by Ubiwhere's application drEVen. We've accessed the risks, but we did not yet implement any particular technical feature which would allow our service to be GDPR compliant. To reiterate: the goal was to experiment with the technology and how feasible it may be for market uptake. GDPR concerns will be addressed in a later stage. As such, we can't comment, at the moment, how VICINITY would aid us with this particular matter.

What is your opinion of the concept that the edge-computing approach with P2P yields higher scalability and dependability features? Why is it important? How are these functionalities helping you?

Edge-computing is a highly-relevant topic for Ubiwhere. We've been following ETSI MEC standards, having also been contracted as a partner of their Specialised Task Force in charge of developing the Testing Framework. There are two main driving forces for this: (i) 5G Edge Computing, with Smartlamppost.com approach, and (ii) IoT pre-processing of data relating to fog. With the former, it is our intention to provide not only Mobile Network Operators with active telco equipment and infrastructure (the marketplace), but also with an Edge Computing platform and co-located computational resources. These will allow them to pre-process data closer to the end-users in order to achieve lower latencies and reduce backhaul congestion. With the latter, in the case of fog, we are able to reduce costs associated with backhaul traffic. This is due to a large amount of M2M and IoT data we pre-process, filter and compress at the gateway level. So, in essence, Edge Computing is a great deal for Ubiwhere to offer for specific cases and products.

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Dr Charith Perera (PhD, MBA)

Lecturer

School of Computer Science & Informatics, Cardiff University, UK

Please highlight here the most relevant parts of your CV.

Currently, I am a lecturer at Cardiff University. I co-lead the UK's largest security, privacy, entrust research program that focuses on the Internet of Things. This is a 14 Million investment by UK research councils. I also work as part-time researcher-in-residence (RiR) at Digital Catapult, in London.

We would like to know a little more about the concept "Sensing as a Service", could you explain it to us?

The Internet of Things (IoT) envisions the creation of an environment where everyday objects (e.g. microwaves, fridges, cars, coffee machines, etc.) are connected to the internet and make users' lives more convenient. It will also lead users to consume resources more efficiently.

The data collected by each of these solutions are used by them and stored in access-controlled silos. After the primary usage, data are either thrown away or locked down in independent data silos. There is a significant amount of knowledge hidden in these silos that can be used to improve our lives (including behaviours, habits, and life patterns) and reduce wastage through efficient resource consumption. To discover such knowledge, it is essential to analyse data stuck in independent silos together on a large scale.

There are three main barriers to achieving this:

- Data owners do not have much control over their data and their data are locked in silos managed by products and services companies.
- Data owners only have access to their own data which has little value when it comes to knowledge discovery.
- Data owners do not know how to discover knowledge from raw data.

The Sensing as a Service (S2aaS) model aims to overcome these barriers. It is a vision and a business model that promotes data exchange between data owners and data consumers. In other words, it aims to create a marketplace for data where data owners and consumers can trade data. In practice, data exchange could be best based on price or on mutual benefit. Check my free book for more details: https://leanpub.com/sensingasaservice

How can VICINITY support the "Sensing as Service"? Can VICINITY to help to overcome some of the challenges?

I think the VICINITY project solves one part of the puzzle. Semantic interoperability is one of the main challenges that we face when we are breaking the data silos. It would be really difficult and unrealistic to expect that IoT products and service manufacturers would follow a single standard. So what we are going to see is that there will be many different products and services which collect and manage data using different standards. When we are creating a data marketplace, we need to gather data from different IoT products and services which follow different standards. I believe that the VICINITY project has role to play in this area.

Another important aspect is to avoid centralization in a potential data marketplace. We have seen a lot of bad things happening in the social media space due to centralization; such as privacy violations with data being sold without consent. In this aspect, the VICINITY project follows a decentralised paradigm which is one of the most important principles when developing a data marketplace. Further, in VICINITY, users get to control of the data and what they want to do with them.

The edge computing nature also helps to preserve privacy and give the ultimate control to the data owners, which is important in terms of the GDPR where data owners are fully informed about what is happening to their data. Edge computing helps data to be processed on the local devices which eliminates the need to send data to the cloud which could ultimately lead to privacy violations.

Peer-to-peer data-sharing helps create a new ecosystem of sharing data among communities. Such an approach helps small communities to get together and develop data-driven services for their own needs without the intervention of large corporations; for example, a community of patients who may have diabetes may share their IoT data, with other similar patients in a limited fashion (without handing over the data to large corporations) in order to develop products and services that matter to them.

What is your area of interest in VICINITY and how do you think you will contribute to the project?

Going forward I think an interesting area would be to look at the data provenance and how to capture the quality of data. Whereas some data items could be semantically similar, the quality of the date depends on various other factors. In the Sensing-as-a-Service' model, data consumers may gather large volumes of data from different data owners. As a result, data consumers have very little idea about how the data has been captured and processed. Without knowing the data provenance, it would be difficult for them to properly process the data. For example, the presence of a person could be identified by different types of sensors and mechanisms such as: motion sensors, cameras, temperature or CO_2 level variations and so on. Therefore, when creating a marketplace for data it is important to attach context information to enable data from different sources to be fused together.

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Sensing VICINITY - Interviews with Martim Longo Pilot Stakeholders

Enercoutim conducted interviews with pilot stakeholders to evaluate the impact of the solutions under development. The users reported that the VICINITY platform is useful and easy to use. It helped them to improve their understanding of resource consumption together with the identity of the buildings and their use. For instance, they found the most innovative aspect to be the ability to connect different brands of sensors. These now provide actionable real-time information about their buildings. Most users revealed that the application is straightforward to learn and understand and so did not require any prior technical knowledge.

Here are some quotes from the questionnaire fielded to the users of the Value-added services at the Martim Logo pilot site:

What features of the solution did you find the most innovative?

A1: The ability to integrate different equipment and brands into one platform.

A2: Get real-time data to be able to act on time.

A3: The idea that, if set correctly, this system has a high potential to fit an extensive range of applications.

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Interview with the Head of School in Martim Longo pilot site

Smart school interview with the Head of school Prof. Antonio Amorim in Alcoutim, Portugal about Value-Added Services:

What is the relevance of the service to the educational process?

The notion of "noise" made by the students is of interest as they can now better understand that they are in fact sometimes making more noise than they should, which helps control the children in a more balanced self-adoptive way.

In terms of CO_2 levels, kids quickly pick up on the relevance of this, and readily understand that action needs to be taken if the level exceeds a certain boundary.

The system has already provided the teacher with opportunities for teaching these new and relevant data driven observations, including teaching the children what actions they can take to counter the effects of too high levels of CO_2, temperature, humidity, UV, etc.

What was your experience of having data in real time from the Enercoutim Value added Service?

Real-time information allows immediate action to be taken which is very relevant to improve the quality of the classroom environment. It also allows for the first time to actually have information available that previously was not. We can manage things, since we have data.

What is the potential impact of the system / data being provided?

The impact is very important as it shows children and adult users the data about their own environments in real time, allowing them to take action to improve. Furthermore, there is so much more that can be done with this information in the future, as digital systems will become part of our daily lives.

Smart Parking success in arctic city Tromsø

The Horizon 2020 Research and Innovation Action VICINITY integrated smart solutions for buildings integrating sharing services with energy and transport.

The Tromsø (NO) pilot site is located at Teaterkvarteret, a newly constructed cluster of buildings in Tromsø city centre and is now complete and fully operational. The number of users were smaller and the organisation different to the originally planned pilot in city of Halden, Norway. More emphasis has therefore been put on the Value-Added Services which have been updated with more focus on user experience and less focus on validating specific standards used in the pilot.


Teaterkvarteret

Teaterkvarteret is part of a complex consisting several buildings, each containing 10 – 24 apartments. Each building is owned by a cooperative and the building residents form part of the pilot stakeholders. Ten of the apartments are allocated to disabled people or persons in need of care. Two rooms are set aside for joint health care activities. Every apartment has access to one parking space.

The parking space.

The Pilot Site managed to achieve its goals, it demonstrates well how VICINITY integrates IoT devices based on different platforms and ecosystems. The Use-Cases served as a proof of concept of how VICINITY could be used to extend functionality, improve on efficiency and reliability, as well as demonstrate what opportunities exist to create new business

solutions that can improve the workday. This was demonstrated through the creation of one framework named P2P Connectivity Platform which was prepared for P2P PARK (UC 1) and P2P Healthcare Visit (UC 2).
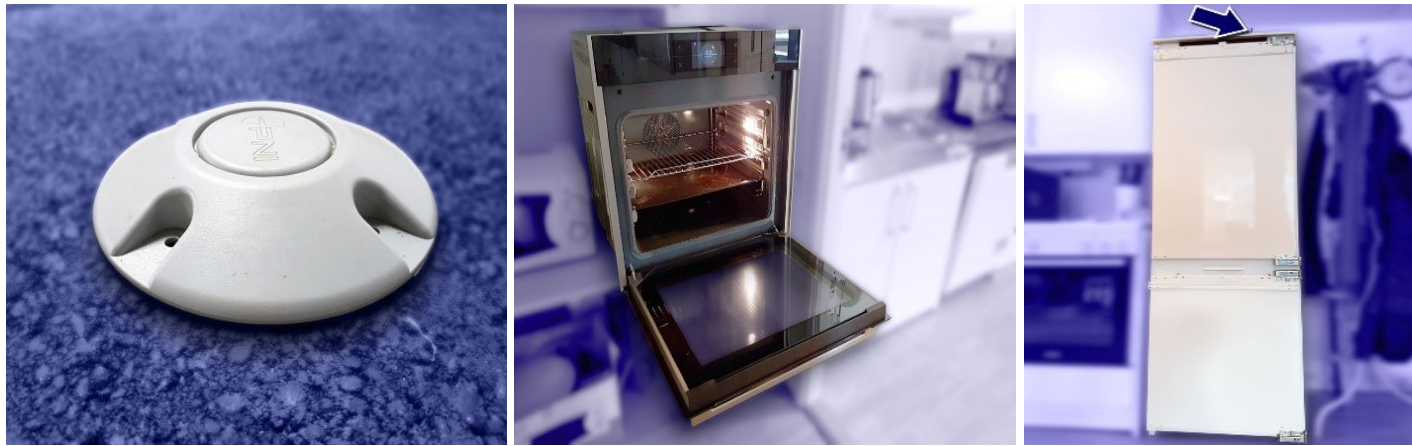
The equipped smart parking sensors and GORENJE smart appliances.

Also, the introduction of subscription services offered by Gorenje for the smart appliances introduced the novel idea of how to remove complexity from a local point of view, thereby reducing the need for in-house staff to do maintenance work. Such smart appliances could be extended to other parts of the local infrastructure.

The stakeholders were generally positive to the project and its outcome and received a lot of public attention from national TV thanks to the (somewhat inaccurate) slogan "airBnB for parking" being introduced and perceived as one of the main Unique Selling Points.

The use cases demonstrate that the results from VICINITY contributed to several of EUs environmental goals, thereby becoming an increasing part of the research and innovation activities that support future sustainable solutions.

The Tromsø Pilot has offered the company Hafenstrom and VICINITY partners a great opportunity for being part of a living ecosystem where the service providers and service users would provide input and be interested in continuous use after the completion of the project. This is something HITS will continue to build upon in further endeavours and exploitation activities.

Examples of smart phone applications for the Tromsø Pilot.

The exploitation phase will include the expansion of the number of areas the system can be applied to with presentation on a single platform. In order to gain traction, the platform is available on GitHub and offering development rights to software companies. Different subscription models for end-users are available for: sharing, renting and transaction services. On a long-term perspective, the solution will migrate into new markets that have yet to be identified offering new solutions built on the strength of Interoperability as a Service as provided by VICINITY.

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The Municipality of Pilea-Hortiatis in Greece has successfully distributed 50 fitness trackers to 50 middle-aged citizens to promote a healthier lifestyle. The results are starting to become visible. Citizens are getting more active as they attend regularly the municipality's sport complex where the beacons are installed. Their main goal is to both exercise and gain more fitness "achievements" points in order to climb in ranking. The residents are also motivated to change their everyday habits and obtain a healthier lifestyle with the help of the dietician who is responsible for monitoring the citizens, by taking their weight measurements, track their daily exercise and examining their improvement through the stored data of the fitness trackers. The dietician also provides them with psychological support by encouraging them to keep up their physical activity and continue even further.

In the next period, speeches about health actions are being prepared along with a social media campaign to spread and promote the beneficial results of the pilot program and encourage a healthy lifestyle.

What are the benefits from VICINITY?

It is important to evaluate the eHealth use case by considering VICINITY USPs together with the services that validate VICINITY platform, and its enablers.

VICINITY Platform benefits both Use Cases at the Greek Pilot Case by allowing the integration of different sensors from different vendors into the same VAS by exploiting the semantic interoperability that it offers. This enables health care providers to be notified about health profiles of the users with only one mobile or web/desktop application for every sensor or device inside the house regardless of the device brand or communication protocol. Moreover, it offers security and data privacy in all transactions, an aspect which is very important especially in the health domain.

The business evaluation is mostly focused on the exploitation of the VICINITY USPs for each of the pilot cases, and taking account of the experience of the users. The technical evaluation is mostly focused on the functionality of the Value-Added services offered.

The methodology for the business evaluation includes the collection of evidence regarding the stakeholders' perception for both the eHealth use cases and the VICINITY platform. The evidence was acquired in the form of questionnaires, which were chosen due to the large number of participants and the structured format that they offer, which allows easy extraction of useful outcomes. Separate questionnaires have been implemented for the different stakeholder categories - "Use case 3.1 participants", "Use case 3.2 participants", "Municipal employees" and "Health professionals".

The questionnaires were distributed to the users of the two use-cases, the employees of the municipality and the health professionals. The elderly and middle–aged people reflected their experience with the IoT devices and sensors deployed to their houses / or given to them, their perception regarding privacy and security of the solution, and their overall experience of their participation in the VICINITY program. The MPH employees and health professionals have also answered their related questionnaires. In cases where the elderly people were unable to answer the questions, their relatives / guardian supported them.

Use Case 3.1 - eHealth and Assisted Living for elderly people at home

A total of 34 elderly citizens' homes have been utilised for the deployment of the VICINITY infrastructure and related Value-Added services and are currently participating in the demonstration of the respective use case. A set of medical Bluetooth connected devices (blood-pressure devices, weight scales) and building IoT sensors (pressure mats, motion and door sensors, panic buttons, connected fridge and oven) have been deployed and maintained at the selected homes. The demonstration is monitored by the municipality health services and further supervised by a municipal doctor employed for this work. Data from these IoT devices are gathered in a GDPR-compliant database through the VICINITY cloud infrastructure, shared with the responsible doctors/relatives based on the authorisation access control framework applied. In order to receive feedback and keep up a close relationship and monitoring of the elderly people participating in the

demonstration, a psychologist is further employed by MPH, who communicates and further pays visits to the elderly people houses.

Use Case 3.2 - Health improvement for the middle-aged persons
A total of 50 middle-aged citizens are participating in the use second use case. The demonstration is supervised by a municipal dietician employed by the municipality, keeping an active communication with the citizens on a bi-weekly basis, by having personal sessions with them at the municipal dietician office. Through this VICINITY demonstration, citizens participated in an "Urban Marathon" organised by the municipality. They were able to gather points by visiting municipal sports centres participating in the demonstration (through Beacon sensors that communicate with the VICINITY services through a mobile application). Citizens' activity data are further collected by wearable trackers (activity trackers) and a connected weight scale. All data are stored in a GDPR-compliant database for further processing by the respective VICINITY Value-Added Services.

Evaluation-What was your opinion of your interaction with IoT devices / sensors?
The interaction of the elderly people with the IoT devices and sensors was generally positive with a small portion of them reporting that they have faced difficulties. Over 85% of the users found the IoT devices useful in their everyday life enabling them to accomplish daily tasks with safety. An important outcome is that over 70% of the elderly users feel more confident living alone than before they were offered the services. Over 60% feel that their doctor is better able to monitor his/her health progress. Moreover, interaction with IoT devices and sensors was generally a positive experience for users. Operating the devices and using the mobile application was easy for them and they found the IoT devices useful in their everyday life.

The Municipality as a stakeholder plays a valuable role in the business evaluation. Several meetings were held during the deployment phase between MPH, CERTH and GNOMON in order to guarantee a smooth pilot operation and to take account of the recommendations from all partners. MPH is more aware of its citizens' needs and believes that the interaction with the IoT devices and services is easy and understandable. However, they have doubts whether to install more sensors/devices to its citizens to provide more services. Especially in the use case 1 where installing devices and sensors to a private home is a challenging procedure and requires careful handling from the technical representatives and the doctors. It is therefore sensible for the employees of the municipality to have doubts regarding the addition of more devices and sensors to the houses.

Doctors participating in the VICINITY program evaluated their experience regarding the use of IoT devices and sensors. 100% of the doctors find the interaction with the IoT devices, sensors and services easy and understandable and would choose to enhance their conventional way of caring with the VICINITY pilot applications to better control the medical condition of their patients. Half of the doctors are undecided whether they would recommend the VICINITY IoT services to other doctors.

Evaluation of Privacy and Security of Personal Data
It is important to evaluate the users' perspective of the USPs in the context of privacy as this pilot is dealing with health data. For this reason, a GDPR compliant database was developed in order to store citizens' medical and building data that will be further evaluated in the following period. Over 60% of the elderly people are confident that their personal data gathered from VICINITY IoT devices won't be shared with anyone not eligible to have them. A smaller portion believes that their data are safe when interacting with IoT devices but a small portion less than 4% disagrees. 100% of the middle-aged people feel confident that their personal data are safe when interacting with VICINITY IoT devices and that the data won't be shared with third parties. Middle-aged people were gathered and informed about the process of the use case solving any doubts they had regarding their data. After explaining VICINITY architecture as simply as possible, they wanted to further participate in the VICINITY program and felt confident about privacy and security issues.

Municipality's employees are 100% sure that GDPR regulations are followed during the processing and storing of citizens' personal data. Moreover, they are sure that data are not shared to third parties because of the GDPR-ready architecture. It is important that 100% of the doctors employed by MPH who participated in the VICINITY MPH use cases are satisfied regarding privacy and security issues and data usage, processing and storage.

Evaluation of overall experience from VICINITY program

Overall experience from the VICINITY program was also evaluated, resulting in positive responses. One of the most crucial conclusions regarding the pilot application is that over 60% of the users think that, through VICINITY program, elderly people could have the chance to live alone more independently than before. Regarding brand perception, over 90% of the users of the eHealth use case would recommend the VICINITY platform and to other people or organizations.

As described before, VICINITY performance is measured by its users and in the eHealth use case, 100% of the users would recommend VICINITY platform and the eHealth use case application to other people or organizations; so the overall experience to them was a positive experience. A small portion of the users faced technical problems but almost 70% agreed that VICINITY responses were helpful and provided assistance when needed. The gamification system was efficient due to the system of points and the wearable device provided. Over 75% of the users increased their daily walking distance compared with their situation before VICINITY and together with the biweekly visits to the dietician, 50% of them claim to have lost weight more efficiently and almost 60% increased their visits to the gym. Generally, over 80% of the participants believe that the VICINITY program can lead to a healthier lifestyle.

Overall experience from VICINITY program was also evaluated resulting in positive responses for the municipality. One of the most crucial conclusions regarding the pilot application is that over municipality's employers think that through the VICINITY program elderly people could have the chance to live alone more independently than before and middle-aged people to have a healthier life and routine. Over 60% of the municipality employers would recommend the program to other stakeholders (municipalities) whereas 30% is still undecided.

Overall experience for the doctors is generally good but 50% of the doctors believe that citizens that are involved with the VICINITY program are not satisfied. This is possibly due to the deployment of sensors and devices to elderly peoples' private homes.

In particular in Greece, it is of key importance to seek for new alternative ways in order to provide new solutions in the health domain, given the low access to quality health services to elderly people in Greece. In the last couple of years, it has been made apparent by the Greek Ministry of Health that there is a changing policy in Greece towards promoting e-health services, in order to improve healthy life expectancy while dealing with diseases and tight budgets. On a larger scale, VICINITY use cases regarding eHealth and assisted living services can contribute towards solving this problem and facilitate by reducing expenditure on hospitals, health institutes and health-care providers.

The value proposition of the 'eHealth & Assisted Living at home' use-case relies on the fact that participants can have the ability to remotely monitor their health by specialized medical staff while staying at home, instead of needing to move in care institutions, therefore leading to reduced primary costs for citizens and municipalities.

The municipality of Pilea-Hortiatis is also taking action by providing to its citizens a "service" for improving their health and reducing future health problems. Citizens benefit from this service not only in their general health but also in the future earnings that they will receive by being able to work longer into later years and by needing expenditure on medicine and less visits to health care providers or dieticians. This service is valuable not only to the citizens themselves but also to the municipality as it aims to reduce future health service costs. On a larger scale, beyond the municipality boundaries, similar competitions could be organized at a national level, or any kind of larger scale, so that, for example, municipalities compete with each other. Moreover, as it was described in previous deliverables, the need for such a solution is enormous, since obesity is increasing more and more each year, causing numerous side-effects and health problems.

For the future we are exploring all possible options for the benefit of the elderly and their carers and the most promising ones will be described in Deliverable 9.14 - VICINITY exploitation and business plan, final version.

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## Pilot results of the Smart Energy Microgrid Neighborhood use-case

The users interfacing with the platform at the pilot site buildings provided input into questionnaires. It can be concluded that stakeholders perceive that the Smart School and Dynamic Audit deliver business value as solutions. Two aspects were evaluated: the use of tools the project delivered and also an overall VICINITY platform solution.

The semantic interoperability in the VICINITY platform that allows for effective integration and use of heterogeneous devices and applications within a use case, regardless of a brand/manufacturer, is highlighted as a unique feature. The possibility of integrating complementary solutions and functions, such as supply and demand management, is positively viewed.

Reviews show positive aspects, namely the fact that the information is presented in a very straightforward way to final users, and it is easy to understand even without technical expertise, the need to learn the system extensively or the need for prior knowledge of the regulatory environments. The system allows users to become aware of new information and this is considered essential, such as the indoor environmental parameters, resource consumption and other parameters impacting health, well-being. Technical parameters for systems optimisation, buildings use and resources consumption were also considered to be valuable.

The richness of data, the flexibility of integration of external data sources, and the dynamic development flexibilities are some of the valued parameters from a system development standpoint that complement users perceptions of the usability of solutions.

The graphic below outlines the three areas of impact driving the value proposition of the overall solution: Interoperability, Collaboration facilitation and efficiency. These impacts can be observed for each Value-added service demonstrated at the pilot site.

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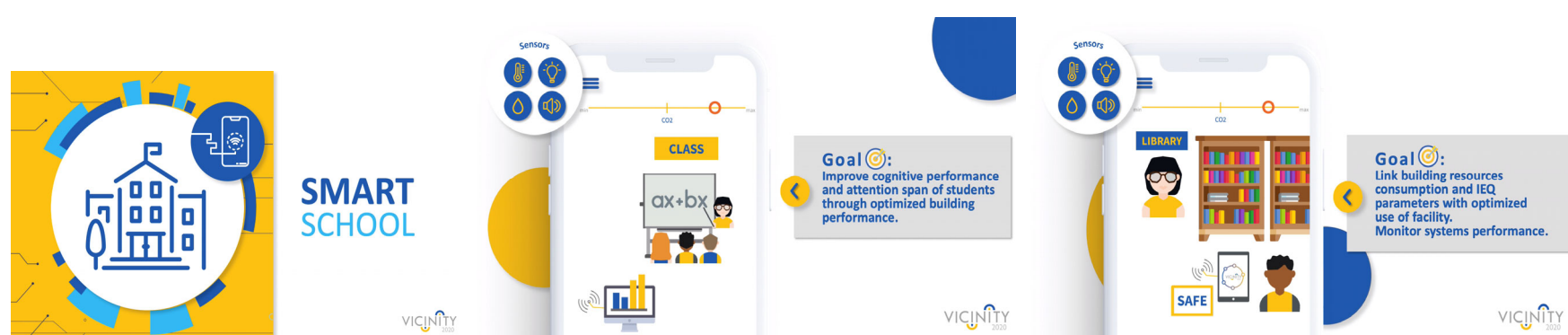
Pilot results of Smart Buildings use-case

The pilot in Oslo has been running since May and has been used and tested by stakeholders. During the Evaluation period, there have been several meetings and a continuous upgrade of the solution as the stakeholders tested and saw several changes that would improve the Use Case. The two Uses Cases showed that the USP, easy integration of different IOT devices and infrastructures, gave the stakeholders a good view of possibilities with the VICINITY platform for Smart Buildings. The stakeholders who used or benefitted from the predictable operation application see possible new business models and improvement of customer value, when integrating IOT solutions in their domain of work.

The VICINITY platform has been stable during this period and changes and updates to VAS have not had any impact on the daily use of the solution.

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