Management Of Networked IoT Wearables – Very Large Scale Demonstration of Cultural Societal Applications
(Grant Agreement No 732350)

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1 Executive Summary

The MONICA project has successfully demonstrated its sound and security technologies at 22 planned open-air cultural and sports events and at four replication settings, in six major cities across Europe.

It has demonstrated to many stakeholders, both from the supply side and the demand side of the value chain, how a large scale IoT ecosystem using innovative wearables, IoT sensors and actuators, can be integrated into an interoperable, cloud-based solution with closed-loop services that are capable of offering a multitude of targeted applications for event organisers and smart city operators.

Security and privacy enhancing features in a trust federation scheme allow all solutions to protect personal data and privacy in compliance with the GDPR regulations. Both event participants and ordinary citizens were involved in validation activities to investigate privacy, security, collective awareness and co-creation.

Moreover, a set of software tools and technical guidelines for developers and system integrators complete the package of results from the MONICA project together with a range of new business model proposals based on new value propositions for involved actors to explore.

This document presents the innovations achieved in the MONICA project. It also presents the dissemination and use of knowledge during the project as well as the initiatives towards facilitating the use of MONICA knowledge results after project end.

The innovations in MONICA comprise six main solutions: Sound Level Monitoring, Adaptive Sound Field Control, Crowd and Capacity Monitoring, Crowd Management and Communication, Visitor Experience and Collective Awareness Platform. The strength of MONICA lies in the comprehensiveness of the solutions in terms of features and integration capabilities, being combined and customised according to the actual needs and being founded on the ecosystems which consider technical, financial, regulatory and human aspects to ensure a wider uptake and acceptance of IoT.

MONICA has had a substantial knowledge impact with more than 100 dissemination activities taking place which include organisation of and attendance at conferences, workshops and meetings as well as authoring and contributing to publications and presentations. Impact is enforced by the 27 scientific publications which have been submitted, most of which are available as open access. To further enable knowledge sharing, 33 public deliverables have been planned as public downloads and at the time of writing 21 deliverables are available for download on the MONICA website: https://www.monica-project.eu/public-deliverables/. The remaining deliverables will be available on the website, once approved by the European Commission.

Some of the knowledge results in MONICA have been and are openly available to external actors for exploitation purposes as part of MONICA's obligation to ensure that knowledge and results are made available for those who would like to use it. Two major outputs are the Online Reference Book and Roadmaps for MONICA Market Replication and the MONICA Software Development Toolbox, offering the knowledge and tools necessary to replicate MONICA solutions or develop new Smart City applications.

In terms of dissemination, project partners continue to create awareness about and share the project results. They actively promote the opportunities of the replication tools after project completion and have events and publications planned for this purpose. In terms of planned exploitation, activities range from further development and commercialisation of the results, to enhancing and extending existing services and to applying the acquired knowledge in further research and projects. In several cases, spin-off companies from MONICA are also foreseen, thus ensuring concrete use of the results.

The sustainability of MONICA is also secured through continual use of and interest in MONICA installations and applications by the pilot and city partners. In general, joint exploitation will occur whenever an exploitation opportunity exists and professional partnerships are already forming, engaging on new ideas and further developments facilitated by the MONICA experience.

As a final note, this deliverable does not include communication activities (press releases, website articles and social media posts, press coverage, newsletters, advertising material) which are available in *D1.3 Final Report*. However, press releases, newsletters and advertising material can be accessed on the project website: https://www.monica-project.eu/press-and-publications/ and information about communication and marketing material produced by the project can also be found in *D12.3 Project Advertising Material 1* and *D12.4 Project Advertising Material 2*.

2 Introduction

This document presents an overview of the MONICA innovations and dissemination activities carried out in the project.

2.1 Purpose, context and scope

The purpose of this document is to present the innovations resulting from MONICA work as well as the knowledge dissemination activities performed to share and foster use of MONICA results.

The document is part of the project management work package, task *T1.3 Project Administration, Monitoring and Reporting* supplementing *D1.3 Final Report* covering the public aspects of that report. It is also associated to *D12.6 Final Replication, Exploitation and Business Plans*, *D9.3 Replication Reference Book and Roadmaps for MONICA Market Replication*, *D11.5 New Markets Segmentation and Sustainable Business Models for IoT Platforms* as well as *D7.6 The MONICA Development Toolbox*.

The main innovations are described in terms of solutions suitable for publication. Descriptions of the specific exploitable results are found in the confidential *D12.6 Final Replication, Exploitation and Business Plans*.

The document does not cover communication[1] activities which are reported in *D1.3 Final Report*. However, information about communication and marketing material produced by the project can be found in *D12.3 Project Advertising Material 1* and *D12.4 Project Advertising Material 2*. Additionally, press releases and newsletters can be found on the project website: https://www.monica-project.eu/press-and-publications/

2.2 Content and structure

Chapter 3 presents the MONICA innovations. Chapter 4 lists the scientific publications, the dissemination activities and the public deliverables generated and shared by the project. Chapter 5 presents the main activities enabling the use of MONICA results during and after the project. Finally, Chapter 6 summarises the plans for disseminating and using the MONICA results after the project, thereby securing the sustainability of MONICA.

[1] Communication is here understood as promoting MONICA and its results to a multitude of audiences, including the media and the public. Sources: H2020 Grant Agreement, Article 38.1.1. and EC Research & Innovation Participant Portal Glossary/Reference Terms.

3 MONICA innovations

The innovations in MONICA comprise six main solutions which are described below. A fuller description of each solution is available on the MONICA website: https://www.monica-project.eu/monica-replication-reference-book and in the public deliverables *D9.3 Replication Reference Book and Roadmaps for MONICA Market Replication* and *D11.5 New Markets Segmentation and Sustainable Business Models for IoT Platforms* available on the MONICA website.

The main innovations are described in terms of solutions suitable for publication. Descriptions of the specific exploitable results are found in the confidential *D12.6 Final Replication, Exploitation and Business Plans*.

The strength of MONICA lies in the comprehensiveness of the solutions in terms of features and integration capabilities, being combined and customised according to the actual needs and being founded on ecosystems which consider technical, financial, regulatory and human aspects to ensure a wider uptake and acceptance of IoT.

3.1 Sound Level Monitoring

The MONICA Sound Level Monitoring solution provides real-time monitoring (measuring and displaying) of sound levels at discrete outdoor locations in the city by the use of high quality, accurate and weatherproof IoT-enabled sound level meters. It can also perform real-time sound analysis so that sound contribution levels from different sources can be separated.

Read more at: https://www.monica-project.eu/portfolio-items/sound-monitoring/

3.2 Adaptive Sound Field Control

The MONICA Adaptive Sound Field Control (ASFC) solution is an advanced sound control system that can impact the sound field outside the scene layout through active and adaptive sound field control. The system can provide an optimised sound field in the audience area (bright zone) while reducing the sound levels in neighbouring areas (dark zones) up to 10dB.

The ASFC system is specifically designed to work in outdoor conditions with varying atmospheric conditions, using IoT devices to extract data and adapt.

Quiet Zones are part of the MONICA Adaptive Sound Field Control solution. They are zones with reduced sound levels established in the concert area to minimise the sound exposure to the staff and the public, thereby supporting the work environment as well as providing hearing protection for the audience.

Read more at: https://www.monica-project.eu/portfolio-items/adaptive-sound-field-control/

3.3 Crowd and Capacity Monitoring

The MONICA Crowd and Capacity Monitoring is an on-site solution consisting of a series of components which can be deployed for a variety of purposes using CCTV cameras, wearables and advanced video analytics. The solution hence collects important information about crowd size and flow (crowd counting), advanced object detection, including vehicle detection as well as early warning of security threats. Providing this information to the MONICA Crowd Management and Communication solution allows security staff to obtain enhanced, contextual real-time oversight and decision support for interventions.

Read more at: https://www.monica-project.eu/portfolio-items/crowd-and-capacity-monitoring/

3.4 Crowd Management and Communication

The MONICA Crowd Management and Communication solution can facilitate the crowd management and response, giving an overview of event activities in real time as well as means for feedback and communication to security and first-responder staff. It is based on information received from IoT sensors in the field which is used to monitor, record and analyse the environment and behaviour of large crowds. This MONICA solution

complements the MONICA Crowd and Capacity Monitoring solution. Combined they represent a total, closed loop security solution for gathering crowd information and presenting this information as decision support for those entrusted with security management during large events.

Read more at: https://www.monica-project.eu/portfolio-items/crowd-management-and-communication/

3.5 Visitor Experience

The MONICA User Experience solutions consist of two digital applications: an event app, enabling visitors to access and negotiate the event more easily and a Smart IoT wristband solution, interacting with users through concert lightshows at festivals or at events with features like polls, attention notifications and connecting through social media.

Providing an event app and an IoT wristband can help to improve the quality of the event and to boost visitor engagement and interest. The aim is to create a positive visitor experience before, during and after an event by preparing the visitor of the visit and by enhancing the event atmosphere through exclusive content or fun interaction between artist and audience and between audiences. Improving the entire visitor journey can improve the overall positive experience of the event and motivate the visitor to return or spread the word. Additionally, the organiser can communicate important information about an event, gain insights into crowd behaviour and needs that help optimise content and procedures and thereby make the event fun and safe.

The MONICA Visitor Experience solution can work as a stand-alone solution, but can also be combined with the MONICA Crowd and Capacity Monitoring with components which can be deployed for a variety of purposes (CCTV cameras and wristbands) and with the MONICA Crowd Management and Communication solution which allows contextual real-time oversight and feedback directly to the visitors' wristbands.

Read more: https://www.monica-project.eu/portfolio-items/visitor-experience/

3.6 Collective Awareness Platform

A Collective Awareness Platform (CAP) is an online citizen-oriented platform that promotes collective awareness about societal challenges by gathering and displaying all related data and information for the citizens.

The challenge for the cities is to find solutions that can bridge the gap between cultural attractiveness and community nuisance when organising events in the inner city next to residential areas. The starting point is creating common awareness of the challenges based on facts and on this background, engage the stakeholders in identifying and developing sustainable solutions.

To this end, MONICA has established a citizen engagement platform at the city level that provides factual information about sound and/or security in the city based on various MONICA sensor data. This knowledge is then used to stimulate a collaborative co-creativity process engaging citizens and other stakeholders.

Read more: https://www.monica-project.eu/portfolio-items/collective-awareness-platform/

3.7 Framing a sustainable IoT ecosystem

The realisation and acceptance of IoT depend on multiple technical, financial, regulatory and human factors which must be accommodated for. To do so, MONICA has developed a framework for a sustainable IoT ecosystem built around:

- A dynamic IoT cloud platform
    - integrating a large amount of heterogeneous IoT sensor data;
    - enabling data accessibility and interoperability of devices, systems and networks, realised by standardisation and open interfaces;
    - providing secure data integration and sharing from device level, transmission of information to stored information.
- A comprehensive ethical and data privacy framework which includes ethics checklists, data protection impact assessments and compliance reports;

- A regulatory framework ensuring compliance and IoT device affordability established through open and transparent competition in the device market thanks to application of harmonised standards and radio spectrum bands and based on IoT-enabling existing devices where possible;
- An impact assessment and validation framework looking at user acceptance and socio-economic impact, thereby ensuring alignment with actual user needs and usefulness of the solutions.

Thus, sustainability is achieved not only through interoperability, standardisation and IoT-enabling of existing devices but also through building the solutions from real user needs.

The value framework that the MONICA solutions bring to smart open-air events is thus:

- finding the balance between urban interests (attracting visitors while considering residents)
- ensuring a safe and enjoyable event experience (the safety and enjoyment of the event goer) and
- framing a sustainable IoT ecosystem (which covers technical, financial, regulatory as well as human aspects).

4 Dissemination of knowledge

The term dissemination covers the sharing of results by making them public 'by any appropriate means other than protecting or exploiting them, e.g. scientific publications'[2].

The following sections provide an overview of the scientific publications produced in the project, registered dissemination activities and public deliverables, all with the purpose of sharing knowledge gained in MONICA.

MONICA has had a substantial knowledge impact with more than 100 dissemination activities taking place which include organisation and attendances at conferences, workshops and meetings as well as authoring and contributing to publications and presentations.

In total, 27 scientific papers have been submitted of which 23 are conference papers and four are journal publications. 18 publications are currently available as open access with a complete list being available on the project website: https://www.monica-project.eu/publications/ and currently, more than 600 downloads have taken place[3]. Moreover, MONICA knowledge has been used by a university student external to the project for a thesis on the use of the MONICA airship which can also be seen on the publication page of the website.

To further enable knowledge sharing, 33 public deliverables have been planned as public downloads and at the time of writing 21 deliverables are available for download on the MONICA website: https://www.monica-project.eu/public-deliverables/ which so far have generated 3,743 downloads[4]. The remaining deliverables will be available on the website, once approved by the European Commission.

[2] Source: EC Research & Innovation Participant Portal Glossary/Reference Terms
[3] As per 1. April 2020, excluding count on ArXiv.org and IEEE Xplore
[4] As per 1. April 2020

4.1 List of scientific publications

Peer-reviewed conference and journal publications.

No.	Type	Title	Authors	Title of the Journal/Proceedings/Book	Date of publication	DOI	Repository link
1	Conference paper	An Adaptive, Data-Driven Sound Field Control Strategy for Outdoor Concerts	Heuchel, Franz Maria; Caviedes Nozal, Diego; Brunskog, Jonas; Fernandez Grande, Efren; Agerkvist, Finn T.	Proceedings of 2017 3rd AES International Conference on Sound Reinforcement. Audio Engineering Society, 2017. p. 10 P2.1.	21. August 2017		DTU Orbit Open Access
2	Conference paper	Parameter optimization of forward sound propagation models using Bayesian inference for sound field control purposes	Caviedes Nozal, Diego; Brunskog, Jonas.	Euronoise 2018 Proceedings. European Acoustics Association, 2018. p. 2301-2308.	2018		DTU Orbit Open Access
3	Conference paper	Analysis of leisure noise levels and assessment of policies impact in San Salvario district, Torino (Italy), by low-cost IoT noise monitoring network	Gallo, Enrico; Ciarlo, Elena; Santa, Manuela; Sposato, Emanuela; Fogola, Jacopo; Grasso, Daniele; Masera, Stefano; Vincent, Bruno; Halbwachs, Yann.	Euronoise 2018 Proceedings. European Acoustics Association, 2018.	27. May 2018	10.5281/zenodo.3482542	Zenodo Open Access
4	Conference paper	MONICA in Hamburg: Towards Large-Scale IoT Deployments in a Smart City	Meiling, Sebastian; Purnomo, Dorothea; Shiraishi, Julia-Ann; Fischer, Michael; Schmidt, Thomas C.	Proceedings of the European Conference on Networks and Communications, EuCNC, 2018.	19. March 2018		ArXiv Open Access
5	Conference paper	Data Pre-processing and Model Selection Strategies for Human Posture Recognition	Zhang, Shumei; Monekosso, Dorothy; Remagnino, Paolo.	Proceedings of 2018 11th International Symposium on Communication Systems, Networks & Digital Signal Processing (CSNDSP).	27. September 2018	10.1109/CSNDSP.2018.8471858	Leeds Beckett
6	Conference paper	Superframes, A Temporal Video Segmentation	Sadeghi Sokeh, Hajar; Argyriou, Vasileios; Monekosso, Dorothy; Remagnino, Paolo.	Proceedings of 2018 24th International Conference on Pattern Recognition.	18. April 2018		ArXiv Open Access
7	Conference paper	MONICA, a European project focused on the Internet of Things for the acoustic quality and safety of outdoor large-scale events	Vincent, Bruno; Gissinger, Vincent; Haddad, Karim; Song, Wookeun; Gallo, Enrico; Doucet, Christophe; Jahn, Marco.	Proceedings of 2018 Internoise, 47th International Congress and Exposition on Noise Control Engineering	26. August 2018	10.5281/zenodo.3482818	Zenodo Open Access
8	Conference paper	Deep Residual Network with Subclass Discriminant Analysis for Crowd Behavior Recognition	Mandal, Bappaditya; Fajtl, Jiri; Argyriou, Vasileios; Monekosso, Dorothy; Remagnino, Paolo.	Proceedings of the 2018 25th IEEE International Conference on Image Processing (ICIP)	2018	10.1109/ICIP.2018.8451190	Leeds Beckett
9	Conference paper	Sound field control for reduction of noise from outdoor concerts	Heuchel, Franz Maria; Caviedes Nozal, Diego; Agerkvist, Finn T.; Brunskog, Jonas.	Proceedings of 145th Audio Engineering Society Convention. Audio Engineering Society, 2018.	2018		DTU Orbit Open Access

No.	Type	Title	Authors	Title of the Journal/Proceedings/Book	Date of publication	DOI	Repository link
10	Conference paper	A Quiet Zone System, Optimized For Large Outdoor Events, Based on Multichannel FxLMS ANC (not peer-reviewed)	Plewe, Daniel; Agerkvist, Finn T.; Brunskog, Jonas.	Proceedings of 145th Audio Engineering Society Convention 2018.	2018		AES
11	Journal paper	A Human and Group Behaviour Simulation Evaluation Framework Utilising Composition and Video Analysis	Dupre, Rob; Argyriou, Vasileios.	ArXiv	24. November 2018		ArXiv Open Access
12	Conference paper	Summarizing Videos with Attention	Fajtl, Jiri; Sadeghi Sokeh, Hajar; Argyriou, Vasileios; Monekosso, Dorothy; Remagnino, Paolo.	Proceedings of 2018 14th Asian Conference on Computer Vision	5. December 2018		ArXiv Open Access
13	Conference paper	Features Extraction Based on an Origami Representation of 3D Landmarks	Montenegro, Juan Manuel Fernandez; Maktab Dar Oghaz, Mahdi; Gkelias, Athanasios ; Tzimiropoulos, Georgios; Argyriou, Vasileios.	Proceedings of 2019 14th International Conference on Computer Vision Theory and Applications	12. December 2018		ArXiv Open Access
14	Conference paper	A Comparison of Embedded Deep Learning Methods for Person Detection	Eunhyang Kim, Chloe; Maktab Dar Oghaz, Mahdi; Fajtl, Jiri; Argyriou, Vasileios; Remagnino, Paolo.	Proceedings of 2019 14th International Conference on Computer Vision Theory and Applications	8. January 2019		ArXiv Open Access
15	Journal paper	Improving Dataset Volumes and Model Accuracy with Semi-Supervised Iterative Self-Learning	Dupre, Robert; Fajtl, Jiri; Argyriou, Vasileios; Remagnino, Paolo.	IEEE Transactions on Image Processing	6. May 2019	10.1109/TIP.2019.2913986	IEEE
16	Conference paper	Scene and Environment Monitoring Using Aerial Imagery and Deep Learning	Maktabdar Oghaz, Mahdi; Razaak, Manzoor; Kerdegari, Hamideh; Argyriou, Vasileios; Remagnino, Paolo.	Proceedings of 2019 International Workshop on IoT Applications and Industry 4.0	6. June 2019		ArXiv Open Access
17	Conference paper	Application of Internet of Things technology for sound monitoring during large scale outdoor events	Haddad, Karim; Munoz, Patricio; Gallo, Enrico; Vincent, Bruno; Song, Min-Ho.	Proceedings of Internoise 2019 The 48th International Congress and Exhibition on Noise Control Engineering	16. June 2019	10.5281/zenodo.3482843	Zenodo Open Access
18	Conference paper	Content-aware Density Map for Crowd Counting and Density Estimation	Maktabdar Oghaz, Mahdi; Khadka, Anish R; Argyriou, Vasileios; Remagnino, Paolo.	Proceedings of the 32nd International Conference on Computer Animation and Social Agents	17. June 2019		ArXiv Open Access
19	Conference paper	Learning how to analyse crowd behaviour using synthetic data	Khadka, Anish R; Maktabdar Oghaz, Mahdi; Watta, W.; Cosentino, M.; Remagnino, Paolo; Argyriou, Vasileios.	Proceedings of CASA 2019, 32nd International Conference on Computer Animation and Social Agents	July 2019	10.1145/3328756.3328773	ACM
20	Conference paper	Emergency evacuation simulation in open air events using a floor field cellular automata model	Strongylis, Dionysios; S. Kouzinopoulos, Charalampos; Stavropoulos, Georgios; Votis, Konstantinos; Tzovaras, Dimitrios.	Proceedings of EPIA-2019, 19th EPIA Conference on Artificial Intelligence	30. August 2019	10.1007/978-3-030-30244-3_53	Springer

No.	Type	Title	Authors	Title of the Journal/Proceedings/Book	Date of publication	DOI	Repository link
21	Congress paper	Adapting transfer functions to changes in atmospheric conditions for outdoor sound field control	Caviedes Nozal, Diego; Fernandez Grande, Efren; Brunskog, Jonas; Agerkvist, Finn T.	Proceedings of 23rd International Congress on Acoustics. Deutsche Gesellschaft für Akustik e.V., 2019. p. 1178-83.	2019		DTU Orbit Open Access
22	Congress paper	Full-scale outdoor concert adaptive sound field control	Brunskog, Jonas; Heuchel, Franz Maria; Caviedes Nozal, Diego; Song, Minho; Agerkvist, Finn T.; Fernandez Grande, Efren; Gallo, Enrico.	Proceedings of 23rd International Congress on Acoustics. German Acoustical Society (DEGA), 2019. p. 1170-77.	2019		DTU Orbit Open Access
23	Congress paper	Long term monitoring of noise pollution in social gatherings places: time analysis and acoustic capacity as support of management strategies	Gallo, Enrico; Shtrepi, Louena.	Proceedings of ICA 2019, 23rd International Congress on Acoustics	9. September 2019	10.5281/zenodo.3687157	Zenodo Open Access
24	Conference paper	Three IoT Wearables in Six European Cities! Reality and Perception	Ibrahim, Rasha; Towndrow, Holly; Monekosso, Dorothy.	Proceedings of IMCL 2019, International Conference on Interactive Mobile Communication, Technologies and Learning			
25	Journal paper	A Bayesian spherical harmonics source radiation model for sound field control	Caviedes-Nozal, Diego; Heuchel, Franz M.; Brunskog, Jonas; Riis, Nicolai A. B.; Fernandez-Grande, Efren.	The Journal of the Acoustical Society of America 146, 3425 (2019)	November 2019	10.1121/1.5133384	ASA
26	Journal paper - submitted	A Deep Learning Model for Small Object Detection	Razaak, Manzoor; Argyriou, Vasileios; Remagnino, Paolo.	IEEE Access Journal	Not released at time of writing	-	-
27	Conference paper	LoRa in the Field: Insights from Networking the Smart City Hamburg with RIOT	Meiling, Sebastian; Schmidt, Thomas C.	EuCNC 2020 European Conference on Networks and Communications	19 March 2020		ArXiv

4.2 Dissemination activities

This list covers registered dissemination activities including conferences with paper submission. See 4.1. Communication activities are not included in the list (press releases, website news articles and social media posts, press coverage, newsletters, advertising material).

No	Type	Title	Authors/project partners	(Publication) Date	Place / Platform
1	Conference organisation	Culture and Innovation - Public Private Partnership Conference	City of Copenhagen (organiser), Praesidio Group, Ring Advocacy, Tivoli and Vaeksthus Zealand (presenters), In-JeT (attendance)	06.02.17	Copenhagen City Hall, Denmark
2	Meetings with sound start-ups, presenting MONICA	Meetings with 30 start-ups where the MONICA project was presented and the perspective of the start-ups to join in the entrepreneurship package	Vaeksthus Zealand	March 2017	Copenhagen Sound, Denmark
3	Conference presentation	Electro-acoustics and MONICA	Technical University of Denmark	16.02.17	Akustikkens Dag 2017 Struer, Denmark
4	Standards Meeting	ECC Spectrum meeting on Drones	Ring Advocacy	06.04.17	Portugal
5	Organisation of networking event with 5 MONICA presentations	Contextual Cyber Security for IoT Spectrum and Standards for IoT Large Scale IoT Pilots in Smart Cities – The MONICA Project Liveable Cities: Sound vs. Noise at Inner City Cultural Events Smart City Torino	HW Communications RING Advocacy Fraunhofer FIT (organiser) Technical University of Denmark City of Torino	22-23.05.17	Fraunhofer Innovation Days, Bonn, Germany. Two presentations available on SlideShare
6	eBook contribution	Cognitive Hyperconnected Digital Transformation Internet of Things Intelligence Evolution, Chapter 8: IoT European Large-Scale Pilots – Integration, Experimentation and Testing	Eisenhauer, Markus; Jahn, Marco Fraunhofer FIT	June 2017	River Publishers
7	Research Showcase	Solving a Security Challenge Published in research brochure	Kingston University	June 2017	Kingston upon Thames, UK
8	Organisation of networking meeting	Meeting with Copenhagen Solutions Lab	City of Copenhagen, Ring Advocacy, In-JeT	01.06.17	Copenhagen, Denmark
9	Organisation of networking meeting	Bits and Beers: City Sound and Noise For startups	Vaeksthus Zealand (organiser), Ring Advocacy, Tivoli (presenters)	08.06.17	Copenhagen Sound, Denmark
10	Conference attendance	IoT Week 2017 Meetings, exhibition	Fraunhofer FIT, LINKS Foundation, In-JeT	06.-09.06.17	Geneva, Switzerland

No	Type	Title	Authors/project partners	(Publication) Date	Place / Platform
11	Event presentation	Presentation of MONICA at the Acoustic Technology & CAMM Presentation Day	Technical University of Denmark	09.06.17	Lyngby, Denmark
12	Conference attendance	3rd AES International Conference on Sound Reinforcement - Paper presentation	Technical University of Denmark	30.08-02.09.17	Struer, Denmark
13	Co-organisation of workshop	Presentation of MONICA at Open Living Lab Days, World Café workshop	Leeds Beckett University	31.08.17	Krakow, Poland
14	Conference presentation	INSPIRE Conference 2017 - INSPIRE a digital Europe: Thinking out of the Box	City of Hamburg	04.-08.09.17	Strasbourg, France
15	Conference organisation	Cyber Security and MONICA National conference with stand	Praesidio Group (presenter and stand organiser)	21.09.17	Copenhagen, Denmark
16	Summit Presentation	Riot Summit 2017	Hamburg University of Applied Science	25.-26.09.17	Berlin, Germany
17	Magazine article	MONICA	Fraunhofer FIT	29.09.17	Das Magazin für Sicherheitskultur, Ausgabe 1
18	Meeting organisation	World Cities Meeting with City of Melbourne	City of Hamburg, Senate Chancellery	09.10.17	Hamburg, Germany
19	Standards workshop	ETSI IoT Week 2 MONICA presentations News article and video Facebook post	Ring Advocacy (MONICA and standards), Telecom Italia (OneM2M platform used in MONICA)	23.-26.10.17	Sophia Antipolis, France
20	Conference presentation	Live Music Summit, music conference	Ring Advocacy	27.10.17	Copenhagen, Denmark
21	Conference presentation	French national conference 8es Assises nationales de la qualité de l'environnement sonore Conference on sound environments	Acoucité	27.-29.11.17	Paris, France
22	Conference presentation	17th Public Safety Communication Europe (PSCE)	HW Communications	27.-29.11.17	Madrid, Spain
23	Seminar presentation	EU-Fördermittel in Hamburg	City of Hamburg	27.11.17	Hamburg, Germany
24	Event attendance	Representation of MONICA at Leeds City Research Forum	Leeds Beckett University	08.12.17	Leeds, UK
2018					
25	Network meeting presentation	Presentation of MONICA at EU meeting City of Hamburg	City of Hamburg	09.01.18	Hamburg, Germany
26	Conference attendance	Connected Smart City Conference Exhibition stand	Atos IT Solutions and Services	11.01.18	Brussels, Belgium
27	Meeting presentation	3rd Meeting of European Nights	Acoucité	01.-02-02.18	Lyon, France

No	Type	Title	Authors/project partners	(Publication) Date	Place / Platform
28	Meeting attendance	47th plenary meeting of ECC (Electronic Communications Committee)	Ring Advocacy	27.02-02.03.18	Lisbon, Portugal
29	Meeting presentation	World Cities Project Exchange- MONICA	City of Hamburg	19.03.18	Melbourne Town Hall – CityLab, Australia
30	Conference attendance	I-ESA18 Interoperability for Enterprise Systems and Applications	Atos IT Solutions and Services Fraunhofer FIT (organiser)	22.-23.03.18	Berlin, Germany
31	Magazine article	The Sound of a Smart City	Brüel & Kjær	April 2018	Customer magazine Waves
32	Magazine article	HørNu	Vaeksthus Zealand	04.04.18	HørNu Magazine
33	Meeting presentation	Eurocities meeting	City of Torino	12.-13.04.18	Florence, Italy
34	Meeting presentation	Smart Cities – How a modern industrial society organises infrastructure and mobility in the wake of digital Transformation - the MONICA Project	City of Hamburg	23.04.18	Hamburg, Germany
35	Conference presentation	Presentation on IoT and MONICA security and sound aspects at Geoforum Smart Building and Planning	CNet Svenska	03.05.18	Sweden
36	General Assembly presentations	General Assembly. Theme: Security of public events. Technological developments for public security. Two round table presentations	Acoucité	18.05.18	Salon de Provence, France
37	Conference presentation	HubIT International Conference	Atos IT Solutions and Services	22.05.18	Bratislava, Slovakia
38	Conference attendance	Euronoise 2018 European Acoustics Association – Two paper presentations	Technical University of Denmark, City of Torino, Acoucité	27-31.05.18	Crete, Greece
39	Workshop attendance	CEPT Workshop on Spectrum for Drones	Ring Advocacy	29-30.05.18	Copenhagen, Denmark
40	Conference Attendance	IoT Week 2018 Exhibition stand	Atos IT Solutions and Services, LINKS Foundation, Dexels, Leeds Beckett University	04.-07.06.18	Bilbao, Spain
41	Meeting presentation	US NPSTC (National Public Safety Telecommunications Council) Enhanced Crowd Safety Incident Prediction and other Applications of Networked IoT devices at large planned events	Ring Advocacy Praesidio Group	17.08.18	Online meeting
42	Conference attendance	European Conference on Networks and Communications, EuCNC – paper presentation	Hamburg University of Applied Science, City of Hamburg	18-21.06.18	Ljubljana, Slovenia

No	Type	Title	Authors/project partners	(Publication) Date	Place / Platform
43	Conference attendance	11th International Symposium on Communication Systems, Networks & Digital Signal Processing (CSNDSP) – paper presentation	Leeds Beckett University, Kingston University	18-20.07.18	Budapest, Hungary
44	Conference attendance	24th International Conference on Pattern Recognition Paper presentation	Kingston University, Leeds Beckett University	20-24.08.18	Beijing, China
45	Workshop attendance	Open Living Lab Days Workshop on end-user engagement	Leeds Beckett University	22.-24.08.18	Geneva, Switzerland
46	Hackathon (1) Organisation	Open Air Hackathon	Vaeksthus Zealand, City of Copenhagen, Praesidio Group, Ring Advocacy	24.-26.08.18	Roskilde, Denmark
47	Conference attendance	Internoise, 47th International Congress and Exposition on Noise Control Engineering – paper presentation	Acoucité, Brüel & Kjær, City of Torino, Fraunhofer FIT	26-29.08.18	Chicago, USA
48	Workshop presentation	Workshop on H2020 programmes University of Malaya	Leeds Beckett University	30.08.18	Kuala Lumpur, Malaysia
49	Conference attendance	25th IEEE International Conference on Image Processing (ICIP) – paper presentation	Kingston University, Leeds Beckett University	07-10.10.18	Athens, Greece
50	Launch event organisation	Official preparatory meeting for the hackathon in Torino	City of Torino	08.10.18	Torino, Italy
51	Event presentation	EPoSS Annual Forum 2018 & MNBS 2018 Joint event presentation	CERTH Information Technologies Institute	16.-18.10.18	Thessaloniki, Greece
52	Conference presentation	Technology Forum 2018	Atos IT Solutions and Services Ring Advocacy	18.-19.10.18	Jasna, Slovakia
53	Conference attendance	145th Audio Engineering Society Convention. Audio Engineering Society – paper presentation	Technical University of Denmark	19.10.18	New York, US
54	Hackathon (2) organisation	Sports events	Leeds Beckett University	26.-28.10.18	Leeds, UK
55	Magazine article	MONICA takes on Techno	Brüel & Kjær	November 2018	Customer magazine Waves
56	Workshop organisation	IoT Forum. In the Wake of IoT – Digitalization of Everything from Supply Chain Management to Outdoor Rock Concerts	CNet Svenska In-JeT	07.11.18	Vienna, Austria
57	Hackathon (3) organisation	Urban Spaces	City of Torino, Fraunhofer FIT, LINKS Foundation	09.-11.11.18	Torino, Italy
58	Conference presentation	IBIT Conference on Event Security	Fraunhofer FIT	20.-21.11.18	Hamburg, Germany

No	Type	Title	Authors/project partners	(Publication) Date	Place / Platform
59	Congress presentation	ECHOPOLIS 2018 Nature and culture-based strategies and solutions for cities and territories: an idea whose time has come	Acoucité	26.-28.11.18	Athens, Greece
60	Conference attendance	14th Asian Conference on Computer Vision (ACCCV2018) – paper presentation	Kingston University, Leeds Beckett University	02-06.12.18	Perth, Western Australia
61	Conference presentation	Sons amplifies: la nouvelle reglementation entre en scene! (amplified sounds: the new regulations come into play)	Acoucité	05.12.18	Rennes, France
2019					
62	Conference attendance	Connected Smart Cities Conference Exhibition stand	In-JeT	17.01.19	Bruxelles, Belgium
63	Consultation workshop	WHO-ITU Consultation on the Make Listening Safe Initiative	Acoucité	13.-14.02.19	Salle B, WHO headquarters, Geneva, Switzerland
64	Workshop attendance	Live DMA workshop	Acoucité City of Bonn Ring Advocacy	20.-21.02.19	Antwerp, Belgium
65	Conference attendance	14th International Conference on Computer Vision Theory and Applications (VISAPP) Two paper presentations	Kingston University, VCA Technology	25.-27.02.19	Prague, Czech Republic
66	Workshop presentation	CREATE the Next Generation IoT eXperience for the Future	Telecom Italia	17.04.19	Amsterdam, Holland
67	Workshop attendance	Live DMA workshop II	Ring Advocacy (moderator)	24.-25.04.19	Madrid, Spain
68	Workshop presentation	JTAV 2019	Acoucité	15.-16.05.19	Strasbourg, France
69	Press Conference presentation	Conference organised by Woodstower Festival	Acoucité	16.05.19	Lyon. France
70	General meeting presentation	Presentation to festival technical directors of the Rhone-Alps region	Acoucité	17.05.19	Lyon, France
71	Conference attendance	International Workshop on IoT Applications and Industry 4.0 (IoTI4 2019) – paper presentation	Kingston University	29.-31.05.19	Santorini Island, Greece
72	Workshop presentation	Project Partners Forum - Societal Challenges and Opportunities of Current or Emerging ICT - ICT challenges that society faces	Atos IT Solutions and Services	04.06.19	Košice, Slovakia
73	Conference presentation	PSCE Conference	Yorkshire County Cricket Club	05-06.06.19	Lancaster, UK

No	Type	Title	Authors/project partners	(Publication) Date	Place / Platform
74	Congress presentations	7th National Conference of Physical Agents - Environmental monitoring: from data production to data analysis. Two presentations	City of Torino Acoucité	05.-07.06.19	Strese, Italy
75	Stakeholder meeting presentation	Emerald Headingley Stadium's Safety Advisory Group (SAG)	Leeds Rugby	10.06.19	Leeds, UK
76	Workshop presentation	RNIT 2019	Acoucité	13.06.19	Dunkerque, France
77	Conference attendance	Internoise 2019 The 48th International Congress and Exhibition on Noise Control Engineering Paper presentation	Brüel & Kjær, Acoucité, City of Torino, Technical University of Denmark	16.-19.06.19	Madrid, Spain
78	Workshop organisation	IoT Week 2019 Exhibition stand, wearables demonstration	Dexels, LINKS Foundation, Leeds Beckett University, Acoucité, Atos IT Solutions and Services, In-JeT	17.-21.06.19	Aarhus, Denmark
79	Magazine Article	IoT Meets Wearables in the Entertainment and Security Market: MONICA at a glance	LINKS Foundation, Telecom Italia	July 2019	University Industry Innovation Network (UIIN)
80	White paper partner	Music is not Noise by Live DMA	Ring Advocacy Acoucité	01.07.19	Live DMA
81	Conference attendance workshop organisation	CASA2019, 32nd International Conference on Computer Animation and Social Agents Workshop: Crowd analysis and applications: Simulations meet video analytics Two paper presentations	Kingston University	01.-03.06.19	Paris, France
82	Conference attendance	19th EPIA Conference on Artificial Intelligence (EPIA-2019) – paper presentation	CERTH Information Technologies Institute	03.-06.09-19	Vila Real, Portugal
83	Conference Attendance	Riot Summit	Hamburg University of Applied Science	05.-06.09.19	Helsinki, Finland
84	Conference attendance	23rd International Congress on Acoustics (ICA). German Acoustical Society (DEGA) – three paper presentations	Technical University of Denmark, City of Torino	09-13.09.19	Aachen, Germany
85	Workshop attendance	ETSI IoT Week Workshop: Learning from the EU Large Scale Pilots	Ring Advocacy	23.10.19	Sophia Antipolis, France
86	Conference attendance	EclipseCon IoT Playground Exhibition stand demo of Digital Situation Map	Fraunhofer FIT	21.-24.10.19	Ludwigsburg, Germany
87	Meeting presentation	Eurocities Forum, presentation of Movida pilot	City of Torino	23.-25.10.19	Oslo, Norway
88	Conference attendance	IMCL 2019, International Conference on Interactive Mobile Communication, Technologies and Learning – paper presentation	Leeds Beckett University	31.10-01.11.19	Thessaloniki, Greece

No	Type	Title	Authors/project partners	(Publication) Date	Place / Platform
89	Conference attendance	Fighting noise in France and Europe	Acoucité	November 2019	Québec, Canada
90	Conference attendance	IoT and Data Science conference Exhibition stand	Atos IT Solutions and Services	14.11.19	Vienna, Austria
91	Conference attendance	Dubai Airshow Exhibition stand	Digisky	17.-21.11.19	Dubai, United Arab Emirates
92	Workshop presentation	Noise monitoring Cities Presentation of MONICA	Acoucité	21.11.19	Lyon, France
93	Award Workshop attendance	Receiving Decibel d'Or reward	Acoucité	02.12.19	Paris, France
94	Conference attendance	International Security Expo 2019	Praesidio Group	03.-04.12.19	London, UK
95	Conference presentation	Presentation of White Paper	Safenetics / PSCE/ GSMA	03.-05.12.19	Paris, France
96	Workshop organisation	MONICA Smart Cities Showcase	Leeds Beckett University, Fraunhofer FIT, Kingston University	12.12.19	Leeds, UK
2020					
97	White paper	Critical Communications IoT Concepts Paper	Safenetics Leeds Rugby (PSCE/GSMA)	15.01.20	GSMA
98	Publication contribution	AIOTI publication study 'High Priority IoT Standardisation Gaps and Relevant SDOs'. Section on MONICA LSP: Identification of an IoT/SRD RF standard for the stable and highly dependable transmission of sensor data	Ring Advocacy	January 2020 (version 2)	aioti.eu
99	Article	"Lighter-than-air" aircrafts application in urban contexts	Digisky	05.02.20	LinkedIn
100	Publication contribution	White paper: Personal data protection for Internet of Things Deployments: Lessons Learned from the European Large-scale Pilots of Internet of Things	IN-JET, Safenetics	February 2020	Project website
101	Workshop presentation	Presentation of MONICA at the final meeting of the ROCK Project	Acoucité	23.04.20	Brussels, Belgium Possibly online due to Covid-19
102	Springer IoT Handbook	MONICA contribution	Fraunhofer FIT, several partners	2020	Online

No	Type	Title	Authors/project partners	(Publication) Date	Place / Platform
103	IERC Cluster book	Chapter on IoT Solutions for Large Open-Air Events	LINKS Foundation, Fraunhofer FIT, Dexels, Optinvent, Kingston University, Brüel & Kjær, CERTH Information Technologies Institute, Acoucité, CNet Svenska	2020	Online
104	Publication contribution	Eurocities publication to help cities better plan sustainable events from a noise perspective – *in planning*	City of Bonn, City of Torino, Acoucité	2020	Online
-	Conference attendance	AI Summit March 2020 Exhibition stand – *postponed due to Covid-19*	Kingston University	2020	Dubai, United Arab Emirates
105	Conference presentation	Spring ITAPA 2020	Atos IT Solutions and Services	19.05.20	Bratislava, Slovakia *Partially online due to Covid-19*

4.3 Public deliverables

Knowledge is also shared through the public documents made available by the project. 33 public deliverables can be downloaded via the project website: www.monica-project.eu/public-deliverables

1. Final Report on Innovations and Use and Dissemination of Knowledge (D1.5)
2. Scenarios and Use Cases for use of IoT Platforms in Event Management (D2.1)
3. IoT enabled devices and wearables 1 (D3.1)
4. IoT enabled devices and wearables 2 (D3.2)
5. Validation of the ASFC and Noise Monitoring System Configuration 1 (D4.1)
6. Validation of the ASFC and Noise Monitoring System Configuration and Model Updating 2 (D4.2)
7. Validation of the ASFC and Noise Monitoring System Configuration and Model Updating 3 (D4.3)
8. ASFC System and Noise Monitoring System for Pilot 1-6 1 (D4.6)
9. ASFC System and Noise Monitoring System for Pilot 1-6 2 (D4.7)
10. Modelling of Complex Dynamics and Information Retrieval for Post-event Analysis 1 (D5.3)
11. Modelling of Complex Dynamics and Information Retrieval for Post-event Analysis 2 (D5.4)
12. Library of MONICA Apps for Smartphones and Smartwatches 1 (D6.5)
13. Library of MONICA Apps for Smartphones and Smartwatches 2 (D6.6)
14. Test and Integration Plan (D7.1)
15. The MONICA Development Toolbox 1 (D7.5)
16. The MONICA Development Toolbox 2 (D7.6)
17. Site Surveys and Pilot Plans for MONICA IoT Platform Pilots (D8.1)
18. Consolidated Demonstration Platform Pilot Progress Report 1 (D8.2)
19. Consolidated Demonstration Platform Pilot Progress Report 2 (D8.3)
20. Impact Assessment and Validation Framework (D9.1)
21. Final Assessment and Validation Report of the MONICA IoT Platform (D9.2)
22. Replication Reference Book and Roadmaps for MONICA Market Replication (D9.3)
23. Acoustics Assessment Report of MONICA Pilot Sites (D10.2)
24. Collective Awareness Platform for Citizen Engagement and Co-creativity (D11.1)
25. Open Data Management Plan (D11.2)
26. Using IoT and Smart City Platforms to Support European Tourism and Culture (D11.3)
27. Entrepreneurship and Innovation Promotion Service Package (D11.4)
28. New Markets segmentation and Sustainable Business Models for IoT Platforms (D11.5)
29. Communication and Dissemination Strategy (D12.1)
30. Project Website and Social Media Platforms (D12.2)
31. Project Advertising Material 1 (D12.3)
32. Project Advertising Material 2 (D12.4)
33. Report on Standards, Regulations, and Policies for IoT Platforms (D12.5)

5 Use of knowledge

Some of the knowledge results in MONICA have been and are openly available to external actors for exploitation purposes as part of MONICA's obligation to ensure that knowledge and results are made available for those who would like to use it.

The following sections highlight the use of MONICA knowledge during the project and knowledge use promoted after project end.

5.1 Use of MONICA knowledge during the project

During the project, MONICA results and knowhow have been available for exploitation through the hackathons and related open data repositories as well as the Entrepreneurship and Innovation Promotion Service Package for new start-up companies. Additionally, MONICA has worked extensively with Live DMA, the European network of live music organisations.

5.1.1 Three innovative hackathon solutions

Three MONICA hackathons were organised in 2018 in Roskilde (Denmark), Leeds (UK) and Torino (Italy) with the participation of developers, entrepreneurs, start-ups and students. The hackathons were organised to promote new market openings for start-ups through the use of MONICA knowledge and data (e.g. from https://torino.monica-project.eu/), and the results reflect emerging IoT market trends: hearables for a consumer market and a data-driven behavioural approach to urban planning.

The winning entry of the MONICA hackathon in Leeds, UK belongs to the 'better hearing' segment as a personal, augmented audio device giving its user control of the auditory environment. In the context of MONICA, stadium visitors are able to control their auditory environment during games thereby making sporting events safer and more inclusive to all: https://www.hearablelabs.com/

As opposed to in-ear devices, on-ear devices seek to free the ear canal, thereby enabling its wearer to be more aware of what goes on in the surroundings while listening to some form of sound. The winning entry of the MONICA hackathon in Roskilde, Denmark is such a device. It is a wireless bone-conduction hearable based on sending sound waves in the form of vibrations directly to the human skull so that the user is spatially aware at all times. It is aimed at people wanting to 'listen to their surroundings and the digital world simultaneously in all sound environments of their daily life with superior sound quality for different hearing profiles': http://www.auricle.io/

In the context of MONICA, three use cases were presented that aim to enhance communications at events:

- Security personnel can be spatially aware at all times, not having to rely on a headset which obstructs the ear canal;
- Sound engineers can perform their operations, such as live sound mixing, and communicate at the same time without it interfering with their sound perception;
- Staff members can use the solution as a regular communications device connected to a body-worn two-way radio.

Smart cities are increasingly using data to understand and change human behaviour as part of the urban planning. The move from monitoring and analysis of data (supply-side data focus) to communication and behavioural change (demand-side people focus) is a necessary next step of the smart city in solving nightlife challenges where public spaces have to accommodate for both partying crowds and residential homes.

The winning solution at the Torino hackathon is an example of using MONICA sound level data to motivate nightclubbers and bar owners in the Torino nightlife to change behaviour. The solution displays monitored sound levels on tablets in bars and media totems in the streets to increase awareness of the noise issues. If noise levels are too high, actions are initiated by the application and again when the crowd manages to reduce the sound levels. To further promote reduction of noise, different economic incentives are also introduced: https://www.monica-project.eu/the-shhh-project-wins-the-third-monica-hackathon/.

At the time of writing, the entrepreneurs are developing a business idea for pubs and restaurants in the nightlife districts based on MONICA platform and with the support of the Agency for Local Development of San Salvario District.

5.1.2 Entrepreneurship and Innovation Promotion Service Package

The IoT Entrepreneurship and Innovation Promotion Service Package is a comprehensive packet of start-up services consisting of access to open data sets and pilot collaboration, a MONICA Software Development Toolbox and a Business Growth Programme with business consultancy.

The package was available as an incubator service for the winners of the three MONICA hackathons described in 5.1.1 who each went into a customised Business Growth Programme to help further develop their brand and winning solution. For the hackathon winner in Leeds this has led to participation in the SoundTech Accelerator Program[5] and for the Roskilde winner further seed funding has been secured through Innobooster[6].

Parts of the package were also accessible to other hackathon participating start-ups through Business Hub Zealand with five other start-ups being involved in the MONICA pilots and events.

To promote elements of the package to more entrepreneurs and SME's starting or developing their business, an information package is available on the MONICA website with presentations on business development and marketing providing A-Z information on getting a business started and further developed:

https://www.monica-project.eu/get-involved/business-consultancy-services/

Additionally, a Europe-wide IoT club for SMEs has been established by the European IoT Large-Scale-Pilots (LSP) Programme to foster collaboration and connection between SMEs or start-ups and enterprises for creation of pilots or idea testing in different sectors. It is possible to join the network here: http://iotnext.club/.

The MONICA Software Development Toolbox is described in Section 5.2.2.

5.1.3 Live DMA collaboration

Throughout 2019, MONICA project partners worked extensively with the European network for live music venues, clubs & festivals Live DMA (Developing Musical Actions)[7] in their efforts to assist Live DMA members in approaching national regulators[8].

In general, there is a growing need for event organisers to understand the regulatory landscape concerning live music, and this need has been further enforced by a 2018 report by the World Health Organisation (WHO) providing 'Environmental Noise Guidelines for the European Region' in which the concept of 'Leisure Noise' is introduced, including nightclubs, concerts and live music venues.

This work has resulted in the White Paper 'Music is Not Noise' with recommendations for local authorities on drafting a good live music policy which is available here: http://www.live-dma.eu/music-is-not-noise-report-outputs/

5.1.4 New standard requirement identified

An important element of the MONICA project has been to assess/identify if the European suite of Radio Frequency (RF) IoT standards was missing some elements, which might improve the performance and value of the MONICA results demonstrated.

With regards to sound, a requirement was identified for a new standard/update of existing IoT standard that provides guaranteed low latency and time jitter for RF connected end-to-end communication. In relation to MONICA, this could ensure a more dependable end-to-end latency for synchronized data interlinking of the many sensors applied with the digital MONICA sound field calculations.

Followingly, liaison activities with the ETSI technical group on Short Range Devices (TG28) have taking place and continue to take place after the project ends.

The finding was included in the comprehensive study 'High Priority IoT Standardisation Gaps and Relevant SDOs'[9] released in January 2020 by AIOTI – Alliance for Internet of Things Innovation, Working Group 3 on IoT Standardisation.

[5] https://www.accelerace.io/sound/
[6] https://innovationsfonden.dk/en/programmes/innobooster
[7] http://www.live-dma.eu/
[88] http://www.live-dma.eu/wp-content/uploads/2019/03/REPORT-WG-ANTWERP_PUBLIC_201802.pdf
http://www.live-dma.eu/wp-content/uploads/2019/07/REPORT-WG-MUSIC-IS-NOT-NOISE-MADRID_201907.pdf
[9] https://aioti.eu/wp-content/uploads/2020/01/AIOTI-WG3-High-Priority-Gaps-v2.0-200128-Final.pdf. SDOs = Standards Developing Organisations

5.2 Use of MONICA knowledge post-project

To facilitate utilisation of results after project end, two main tools are available: A software development toolbox for developers of smart city solutions and an online replication reference book and roadmap for stakeholder wishing to replicate the MONICA solutions. Both will be promoted through project and partner channels.

5.2.1 Online Replication Book and Roadmaps for MONICA Market Replication

Based on an analysis of the environmental (resource efficiency), societal (general public engagement, user acceptance) and regulatory (public authorities) aspects, the project has derived recommendations for the replicability of MONICA solutions. The results are included in the deliverable *D9.3 Replication Reference Book and Roadmaps for MONICA Market Replication*, which is also available online.

The aim of the online replication reference book is to provide sufficient information to event organisers, smart city operators and solution developers who are interested in replicating the MONICA's IoT platform and solutions. The six solutions are presented to the visitor as shown in Figure 1.

Figure 1: MONICA Online Replication Reference Book

For each solution, an overview with application areas, type of locations and main features is presented. There are also detailed descriptions of the technologies, useful suggestions on the installation, a description of the business aspects and the regulations from a technical and ethical perspective. This provides a holistic view incorporating the technical, financial as well as human aspects necessary for a successful uptake.

https://www.monica-project.eu/monica-replication-reference-book/

5.2.2 MONICA Software Development Toolbox

MONICA is offering an open software development toolbox with generic enablers which allows developers to build new applications to be deployed on the MONICA platform. The development platform consists of a toolbox and a set of tutorials and guidelines. MONICA generic enablers will be made available in an Open Source GIT and can be used by entrepreneurs, start-up and established companies alike.

https://github.com/MONICA-Project

Presently, the developer toolbox is utilised by several project partners in their provision of solutions and services and is also promoted by cities in calling for new solutions to city challenges in terms of noise and safety. A comprehensive description of the toolbox is available in the public deliverable *D7.6 The MONICA Development Toolbox 2*.

5.2.3 IoT Catalogue

The IoT Catalogue https://www.iot-catalogue.com/ is an outcome of the Communication and Collaboration Strategy, Dissemination and Events Management activities in CREATE-IoT, one of the two Coordination and Support Actions in the IoT European Large-Scale Pilots Programme.

At the time of writing, MONICA is providing contents and results from the work done under Task 9.5 *Scalability and Replicability of the Demonstrators*, namely the *D9.3 Replication Reference Book and Roadmaps for MONICA Market Replication*.

Since The IoT Catalogue is 'the one-stop-source for Internet of Things (IoT) knowledge, innovations and technologies, aiming to help IoT stakeholders (developers, integrators, advisors, end-users, etc.) to take the most advantage of the Internet of Things for the benefit of society, businesses and individuals', this activity gives extra visibility to MONICA solutions and results.

5.2.4 Experimental platform

Local initiatives also exist which put MONICA knowledge into play. In Lyon, an experimental platform for display of acoustic measurements in real-time has been established based on the MONICA experience.

The platform aims to adapt/extend the MONICA Sound Monitoring solution[10], which initially concerned management of sound of open-air cultural events, to an application in environmental acoustics.

For example, sound monitoring for urban transport noise was, until a few years ago, dedicated to observe the evolution of sound levels through long-term periods (month, year). Introducing real-time sound level monitoring can complement this approach giving another analysis tool for local authorities and the public to assess the acoustic environment of their city.

The experimental platform is composed of Class 1 Sound Level Meters as well as low cost sensors currently measuring sound levels in four locations across Lyon Metropole. By comparing the data of these two types and assessing their reliability, it can be determined whether it is worthwhile to deploy long-term sound level measurements at more locations in the city.

The platform is accessible through the website (in French): http://mesures.acoucite.org/accueil.

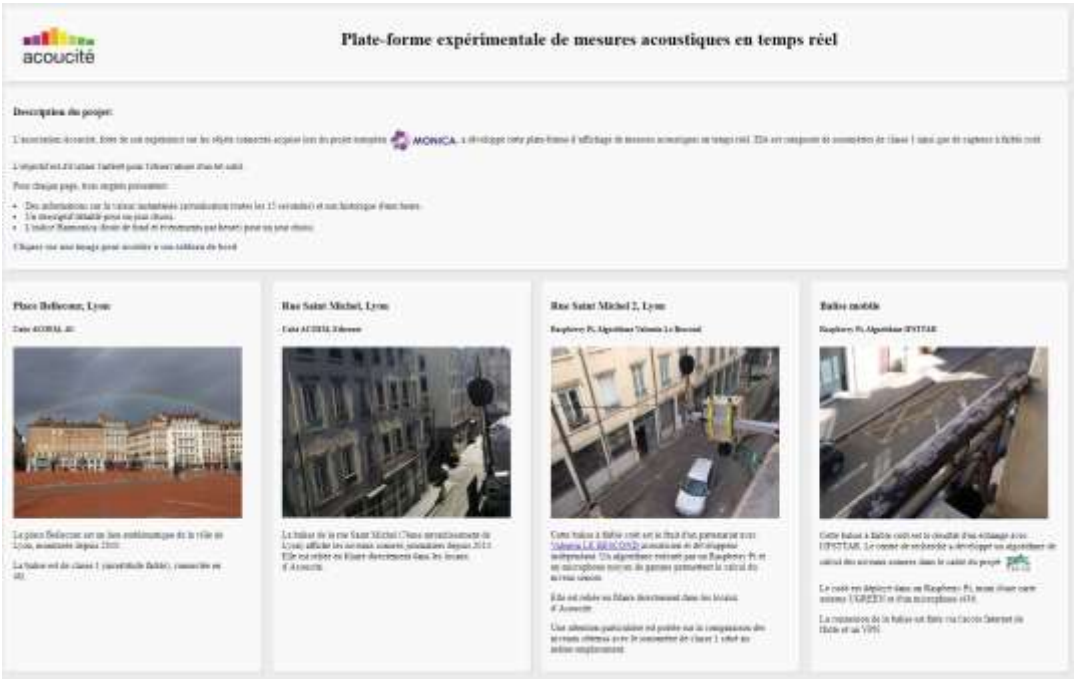

Figure 2: The experimental platform by Acoucité, Soundscape and Noise Observatory of Greater Lyon

[10] https://www.monica-project.eu/portfolio-items/sound-monitoring/

6 Dissemination and exploitation plans

Through its many successful demonstrations and replication activities, the MONICA project has generated and disseminated several significant results which have concrete value for society and which are exploited after the project comes to a close, thereby securing the sustainability of MONICA.

In terms of dissemination, project partners continue to create awareness about and share the project results and promoting the opportunities of the replication tools. Events and publications are planned for this purpose.

In terms of exploitation, the goal is to effectively use MONICA results after the project ends. Exploitation entails both the utilisation of results by project partners in MONICA and facilitating the use of results for people outside the project as presented in Chapter 5.

For the former, the objectives of the exploitation planning are to identify, describe and assess the exploitable results and align them with partners' individual business strategies and plans. The MONICA project has therefore established and followed an exploitation roadmap that goes from identification of exploitable results, analysis of market and business to formulation of exploitation and business plans which detail the utilisation of results after the project ends.

Results cover both tangible and intangible outcomes of MONICA which project partners plan to exploit in various ways. Tangible results cover the concrete technical products, components and services, developed during the project lifetime, with the potential of commercial exploitation. In this category, the project has identified 29 exploitable results within the solution areas detailed in Chapter 3.

Intangible results are based on the general knowledge coming from MONICA which is used by project partners for further research and standards activities, collaborations with municipalities and organisations as well as for scientific publications and conferences, training and consultancy offerings.

For the industrial project partners supplying technologies, the primary focus is on further development of the MONICA results into commercial offerings as well as enrichment of existing commercial solutions and offerings based on the results and knowledge gained in MONICA. Partners have also increased their domain expertise within MONICA which are either formed into new offerings or used in other business areas.

Consultancy partners use the results as part of consultancy packages, enhancing and extending existing services as well as opening up new categories for consulting and training activities.

For the research partners, the plan is to apply the acquired knowledge, results and competences in further research and deployment activities (national and international projects), in collaborations with stakeholders (local government, industry, organisations) and in the provision of higher education.

In several cases, spin-off companies from MONICA are also foreseen, thus ensuring concrete use of the results.

On the demand side, sustainability of MONICA is ensured through continual use of and interest in MONICA installations and applications by the pilot and city partners. Additionally, replication activities are planned by adding new deployment settings with MONICA as a 'good practice' reference point.

Joint exploitation will occur whenever an exploitation opportunity exists and professional partnerships are already forming, engaging on new ideas and further developments facilitated by the MONICA experience.

7 List of Figures

7.1 Figures