



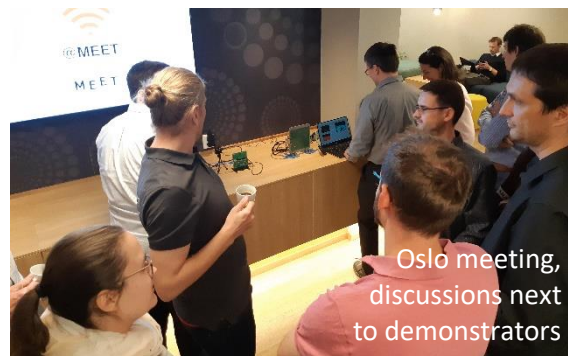
SILENSE | (ultra)Sound Interfaces and Low Energy iNtegrated SENSors

PROJECT NEWS (2ND YEAR)

Second year of the project meant huge progress on all project work packages. In last newsletter we focussed on the automotive domain, especially on personal cars. In this one we would like to present you the applications of ultrasound technology in the field of smart home and buildings with these use cases: access control, touchless interaction in building and in medical environment.

In the second year the project consortium has worked hard on approaching the goals tuned after the first review meeting. On the 18th and the 19th of October already the fourth meeting of our SILENSE partnership took place; this time hosted by our British partner Speedo in their London office. With some exceptions all partners joined the meeting and carried out a lively debate on the latest developments of their technologies and respective integration into all the demonstrators. The need of the full support of all work packages and equally the importance of the demonstrators clearly indicating their requirements to advance jointly and swiftly were stressed. The London meeting was also used to intensive the collaboration within work package 5 (Algorithms and application software) as well as demo 2 (Under water communication for wearables). The involved partners met already a day before in order to discuss their next activities.

On 27th and 28th of May 2019 the consortium met for the fifth time; this time hosted by our Norwegian partner SINTEF. Almost all partners joined the meeting and carried out multiple presentations on results of their work after two years of the project. The main topics of two-day meeting were: overview of each work package, current status of demonstrators, standardization overview and notes on dissemination & exploitation. On the second day some time was used for group discussions focused on demonstrators. During whole event the time of coffee breaks was used for fruitful debates around physically presented demonstrators.



PROJECT NEWS (3RD YEAR)

In the beginning of the third project year, second review meeting took place in Brussels on the 18th of July 2019. The reviewers evaluated achievements and were pleased by progress made in the second year of the project.

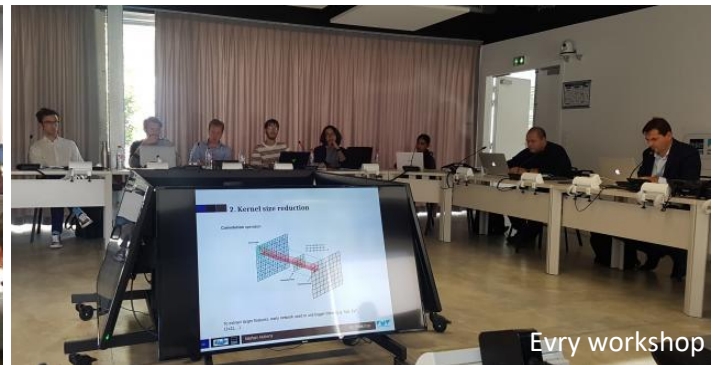
On the 20th of September, partners interested in Machine Learning Algorithms held one day workshop in Evry (France). Current state of Machine Learning based algorithms for use with ultrasound were discussed.

From the 6th to the 7th of November 2019 already sixth project meeting took place in Prague; organised by Czech project partner IMA. During the meeting, presentations of the actual state of demonstrators take turns with live discussions how to make results even better in remaining 6 months of the project.

From the 1st to the 2nd of April the seventh and the last project meeting was planned to take place in Evry (France). Unfortunately, the Covid-19 pandemic took place, therefore the meeting was organized online. All key results of the project were discussed with focus on the last remaining steps to be taken until the official end of the project and keeping in mind the final review planned in Brussels in the end of June 2020.

Brussels 2nd review

Prague meeting



Evry workshop

PROJECT OUTCOMES

Last two years are rich in public outcomes. The consortium was presented at event EFECTS in Lisbon (11/2018) - European Forum for Electronic Components and Systems, where the project dissemination team actively participated with SILENSE booth presenting the ultrasound technology for wearables, smart homes and buildings and automotive. This presentation was enhanced with live demos during EFECTS in Helsinki (10/2019).

During the London meeting (10/2018) [the propagation video of SILENSE technology](#) was finished and shared with partners. It is available for public to increase interest in ultrasound technology and intended applications.

In scientific community the project outcomes were presented in 3 scientific journal papers and in 19 conference papers so far. The technology was presented to industrial sphere on more than 20 events from project partners open days to trade fairs or exhibitions.

From technology point of view, two most notable outputs are that the first large batch of ultrasound transducers made by INFINEON are now implemented in multiple demonstrators. Around the end of the project next generation transducers with digital output will be ready. The second great fact is, that TNO researchers successfully transmitted data from swimmer to side pool via ultrasound channel during experiment.

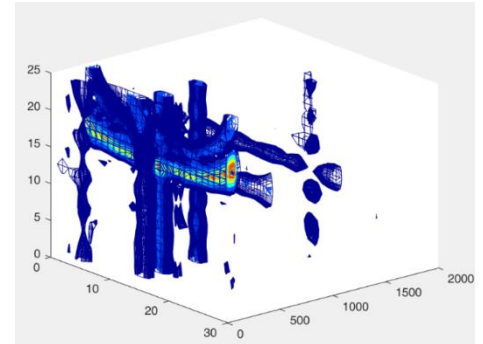
All publishable outcomes of the project can be found on the project website at <https://silense.eu/publications>.

SMART ACCESS CONTROL FOR HOMES AND BUILDINGS

Enhancing existing access control system with gesture recognition can be done to get contactless control of smart access control systems.

UTIA, IMA and BUT are collaborating on already second-generation ultrasound gesture detection prototype. The design is based on Xilinx SDSoC tool as processing hardware and INFINEON provided transducers as parts of ultrasound array. These transducers are results of SILENSE project.

The design including sources and captured data is already available to the SILENSE partners. Several approaches to the hand gesture detection were evaluated. The SDSoC flow capable to support future DSP chain, its development and debugging is done. Beamforming with ultrasound array

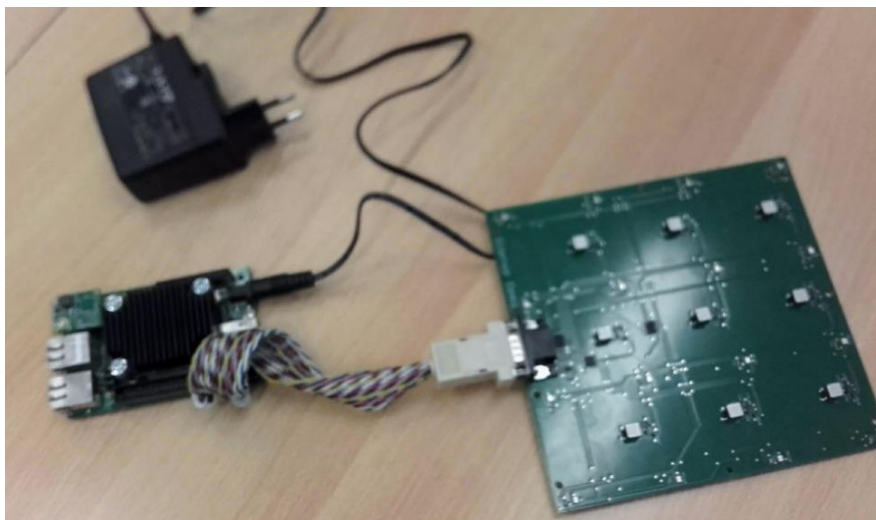
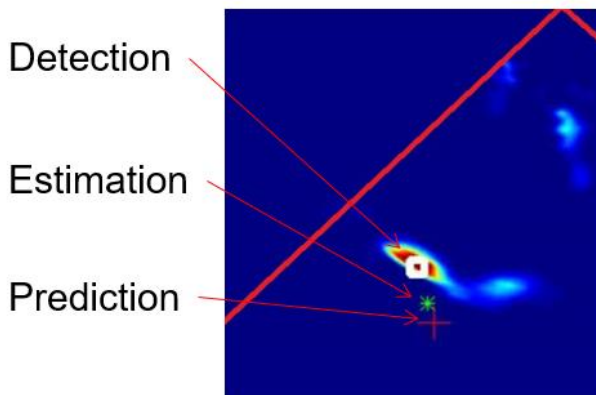


is used to get useful

data that can be now visualised and used to train gesture detection using 3D-CNN machine learning algorithms.

Multiple microphone array configurations were tested to find out optimal processing solution and requirements for the final demo prototype. Part of the work were implementation of PCB, DSP accelerators in FPGA, analysis of minimum number of microphones needed and noise reduction in captured data.

In resulting demonstrator the gesture control will be implemented within IMAporter access control system.



PROJECT TEAM CHANGES

New partner joined the project in early 2020. Spanish company Alteria Automation replaced AlphaSIP as a project partner. Just in few months, based on collaboration with medical professionals, Alteria redesigned prototype for touchless interaction in medical environment. In remaining months, they focus to finalize ultrasonic device for touchless control for verification in hospitals.



SILENSE is an ECSEL JU project and brings together 32 partners from nine European countries. It started in May 2017 and is also supported by the respective National Authorities.

The project researches acoustic technologies and develops concepts to activate and control devices by gesture, data communication, and indoor positioning. These concepts will be used in different domains: wearables, automotive and smart home application.

TOUCHLESS INTERACTION IN MEDICAL ENVIRONMENT

SILENSE project partners AlphaSIP and Idonial were developing jointly a system to improve the live of people that is forced to remain long periods at rest in a hospital or caregiving centre. This system will allow patients to interact with their room environment without having to reach for a control and without getting up from their beds.

The system is based on an ultrasound sensor that will detect and identify hand gestures even in total darkness. The gesture recognition is done through a neural network, trained specifically for the job. The system can also send alarms to the caregivers based on the abnormal patient behaviour. From the beginning of 2020 Alteria took this task, made a redesign and is now focusing on testing in medical environment.



USER PRESENCE DETECTION

Existing and widely used smart home devices today use speech interfaces to interact with the user. The device is set to start with the “wake word”, such as “Alexa” or “OK Google”. While this mode of initiating interaction is simple, the device needs to constantly listen for the wake word to see if a user is nearby. Such requirement can lead to false triggering, or worse yet, constant eavesdropping and intrusion on the user’s privacy. As part of the SILENSE demonstrators, Elliptic Labs is developing presence sensing using ultrasound. By sending ultrasound signals and analysing the received echoes, the presence of the user can be accurately sensed at defined distance from the device. When this functionality is embedded in a smart device, it only needs to get ready for interaction when a user is within the defined interaction zone.

To validate the concept, a prototype was first built using off-the-shelf components that is sending ultrasound signal at 40 kHz. The received echo is then analysed for changes in Doppler frequency. In the next generation prototype, a Knowles Smart speaker development board was used. Here the onboard speaker transmits ultrasound chirps. A classifier to determine if a user is present is trained using machine learning. The end result is a fully embedded presence sensing module for the smart speaker, that is able to sense user presence at 1m distance. The machine learning based classifier is able to significantly improve the robustness of presence sensing, by including various disturbances and in the training data set.

The smart speaker has been shown to perform well in various acoustic environments, including for example, meeting rooms, offices, homes, hotel foyers, and industry conventions.



You can look forward to more details about Smart Wearables in the next newsletters. For more information about project see our project website: SILENSE.eu.