The AMANDA project has received funding from the European Union's Horizon 2020 Research and Innovation programme under grant agreement No. 825464

NEWSLETTER No.5

February 2022

AutonoMous self-powered miniAturized iNtelligent sensor for environmental sensing anD asset tracking in smArt IoT environments

IN THIS ISSUE

AMANDA

The world in your hands

WELCOME TO THE 5TH EDITION OF THE AMANDA NEWSLETTER!

Dear reader,

As another year came to an end, we wanted to take a moment to wish you all the best in 2022! Despite the ups and downs, we hope that 2021 has been a successful year for you and your organisation. Thank you for all the support you showed us in the previous year and for taking the time to collaborate with us.

We gladly inform you that AMANDA has successfully achieved 37 months of progression on the project, and we are inviting you to look through this 5th edition of our newsletter. In this issue, we want to share with you the main highlights of the technical work progress and information on the participation of the AMANDA project at relevant events, especially trade fairs that today look a bit different, and are becoming hybrid, hosted live at the trade fair venues and virtual.

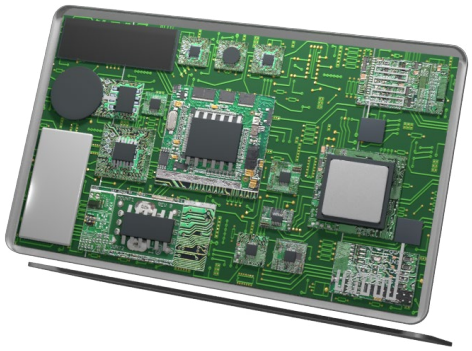
Last but not least, we inform you about our upcoming events in the following months, so take a look and visit us if you plan to attend some of the listed events. We hope you'll enjoy reading the 5th edition of the AMANDA newsletter, and we kindly invite you to follow us and learn more on our social media profiles (LinkedIn, Twitter, YouTube), and visit the AMANDA website.

AMANDA partners

The AMANDA Consortium

AMANDA unites eight partners from Greece (CERTH – Project Coordinator), Switzerland (ZHAW, MICRODUL AG), Netherlands (IMEC), UK (ILIKA, LIGHTRICITY), Belgium (E-PEAS) and Croatia (PENTA) in one effort to design and develop a maintenance-free, miniaturised and easily deployable Autonomous Smart Sensing Card (ASSC) for environmental sensing, as well as for asset and people tracking / monitoring in smart living and working environments.

Concept and motivation



AMANDA is a European project funded under the Horizon 2020 programme, which focuses on developing an **intelligent system with miniature dimensions and ultra-low-power consumption that can be easily installed or used as wearable and with a maintenance-free lifetime of more than ten years**. Our motivation for research, development and innovation, i.e. implementation of the AMANDA project, comes from a growing need for a sophisticated approach to solve problems in smart cities (air quality monitoring, temperature, humidity, noise and occupancy), people and asset security (imaging, tracking, data privacy, cybersecurity) and the pandemic. To help tackle the COVID-19 outbreak, the Consortium identified a health-related use case and scenarios, and promptly recognised the global health and medicine market as relevant to the technology developed in the project.

- **Extreme miniaturisation**
- **Ultra-low power consumption**
- **Data security and data privacy**
- **Advanced sensing technology**
- **Long-range wireless tracking capability**
- **Intelligence**

CHALLENGES TOWARDS SUCCESS

The AMANDA Consortium is designing and developing a maintenance-free, miniaturised and adaptable Autonomous Smart Sensing Card - ASSC for multipurpose environmental sensing and asset tracking in smart living and working applications (indoor, outdoor and a wearable version). The ASSC has a large number of interacting sensors (sensor fusion) in support of versatile use scenarios for applications in the context of smart cities, smart homes and intelligent working environments.

Furthermore, in AMANDA, we developed a new energy system consisting of an innovative Photovoltaic harvester, a rechargeable solid state battery, along with the respective smart power management module. AMANDA develops and integrates energy-efficient monitoring and data processing intelligence within the card to reduce energy requirements at processing. The Consortium implements energy optimisation and control algorithms concerning the available power supply capabilities (i.e. PV harvester and batteries), taking into account and minimising energy losses. In addition, software optimisation techniques are applied to reduce the required load for the processing tasks, particularly in relation to built-in intelligence.

Seven Milestones officially completed!

MS1	AMANDA system specifications and architecture
MS2	Successful completion of the sensors development
MS3	Sensors prototypes finalisation and setting-up sets of multiple sensors
MS4	Full version of the Energy Autonomy Booster
MS5	AMANDA wireless communication technologies
MS6	Full version of the AMANDA Edge intelligence and user interfacing
MS7	1st unconstrained AMANDA card prototype

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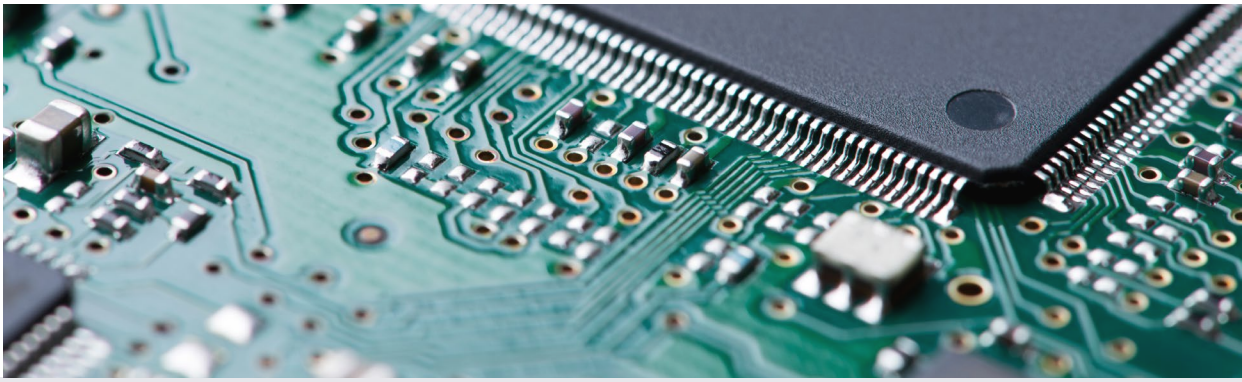

Entering the last year of the project

Looking back on the past 37 months, we can say with pleasure that the activities in all work packages are carried out effectively and successfully. Partners are working hard to complete the development of all components, integrate results, as well as to deliver the miniaturised ASSC (Autonomous Smart Sensing Card) prototype. Past months were very intense and productive as all AMANDA partners have made substantial efforts to develop and evaluate the ASSC's key components. The final architecture of the system was created for both breadboard and integrated/miniaturised systems. Based on the updated use cases and scenarios, the components and basic blocks of the architecture were adapted to the final system specifications. The firmware development and optimisation of the ASSC's sensors is also successfully completed and offers the system with the means to control the ICs on the PCB, to collect the environmental data that the sensors produce and to supply the higher software layers with the collected data.

The completed AMANDA data fusion optimisation engine ensures the optimisation capabilities required to enable the low-power, low-cost and maintenance-free design of the ASSC. Furthermore, an additional evaluation was performed on the EXL-1V20 and EXL-1V50 energy harvesters and reliability testing was completed. Concerning the energy storage element, the Consortium decided to change cell type to ensure the smaller size, greater yield and higher energy density. The smaller size of each cell makes the element less vulnerable to cracking if the card is flexed. Implementation of the different wireless technologies used with the AMANDA card (BLE, LoRa, NFC) is completed, as well as the implementation of cybersecurity mechanisms, edge intelligence and user interfacing module. We are also pleased to announce that the size-unconstrained prototype is designed, developed and manufactured, as well as validated in terms of functionality and evaluated in terms of power efficiency.

PARTNER IN THE SPOTLIGHT - ILIKA

Interview with Dr Denis Pasero, Product Commercialisation Manager at ILIKA

Tell us more about ILIKA and give us a brief overview of the work you do in AMANDA

Ilika was formed in 2004 and was originally a start-up from the University of Southampton in the UK. From 3 people at the time, we have grown to 70+ employees, mainly located in the UK, but with presence in the US, Israel and China. Initially, we started our journey as an R&D company, accelerating materials discovery for our customers. We had patented a method of producing many materials rapidly using a Physical Vapour Deposition technology, and we used high-throughput synthesis techniques and combinatorial measurement methods to produce rapidly large libraries of materials with different chemical compositions and pick up which were the best ones.

Applications were varied, from optical, dielectric, magnetic materials to fuel cell and battery components. In 2008, we started a long collaboration with Toyota in the area of solid electrolyte materials for electric vehicles. At the time, Toyota already knew of the potentially unsafe aspect of lithium-ion batteries and were looking to develop safer solid alternatives. We co-authored several patents, and this gave us momentum to look further into developing solid battery materials, creating our own IP in this area. This led to the creation of **Stereax**, the brand name for our **miniature solid state batteries**, which we have developed to meet the needs of Medtech and IoT solution designers. In fact, around 5 years ago, we pivoted from being an R&D contractor to a company solely focused on designing and manufacturing solid state batteries. In December 2021, we opened our first manufacturing facility for Stereax.

What are the advantages of ILIKA's solid state batteries over the existing technology / batteries on the market?

The initial attraction for solid state batteries was their safety: they do not contain the toxic liquid that you see leak out of conventional batteries and corrode the rest of the components. They also don't suffer from thermal runaway, i.e. the process that leads to some batteries sometimes exploding. Upon developing these materials, we discovered more advantages: because we don't need a metallic case or pouch to avoid the electrolyte liquid from leaking out, we can make cells that can be much smaller than coin cells or small pouches. In terms of footprint, we are developing a battery that is ~20mm^2, 10 times smaller than conventional coin cells, for example. In terms of thickness, a cell can be as thin as a hair. We also understood that without additional packaging, we could develop batteries that have more energy and power than could be achieved from metallic casing technologies at that scale.

PARTNER IN THE SPOTLIGHT - ILIKA

Interview with Dr Denis Pasero, Product Commercialisation Manager at ILIKA

Except in the AMANDA project, give us examples of where ILIKA's solid state batteries are used or could be used

The features I have listed are highly sought after in applications where space is an issue. Our key market is implanted active medical devices. Here, because of the size of the available batteries right now, there are very few "pockets" in the body to fit a large device: these are typically either in the chest or the buttocks, the latter being particularly uncomfortable for the patients. A new generation of disruptors in this field are making use of great advancements in ultra-low power, miniaturised electronic components to reduce the size of the implanted device. The advantage here is that the implants can be placed nearer the organ it is intended to target, making the therapy more efficient; because the device is small, the procedure for implantation can be much shorter and with less risk of complications.

A lot of inspiring work include the development of miniature neurostimulation devices, i.e. devices delivering electrical impulses onto nerves to treat conditions such as Parkinson's, chronic pain, dementia, sleep apnea etc. Other companies are seeking to place sensors in artificial orthopaedic joints (hip, knee, shoulder…) to ensure that the bone has re-grown successfully around the implant. Others want to place pace-makers inside the heart via arteries. In a lot of these cases, the battery itself needs to be extremely small. And of course, the area of smart contact lenses, used for medical applications but also Augmented Reality are another sector where miniature batteries are the only solution to power the device.

In 2018, we added a second branch to our business, still around solid state batteries, but this time at a much larger scale, that of electric vehicles. By the beginning of the next decade, vehicles powered by Internal Combustion Engines will be banned in many countries, to be replaced by electric vehicles powered by batteries. The demand for batteries with ever increasing performance is huge, and it is thought that solid state batteries will, in the next few years, take over from where conventional lithium-ion batteries have stagnated to.

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AMANDA launches the first Application Note

We are glad to announce that the first version of the Application Note has been released and is available on our project website in the Dissemination Materials section!

The first version of Application Note describes the architecture and components integrated in the Autonomous Smart Sensing Card (ASSC) developed in the AMANDA project by H2020 partners. Application Note explains the technology, performance and abilities of the AMANDA card, and it contains the following subsections: project concept, use cases and incorporated scenarios, conceptual architecture, wireless communication levels, mechanical specifications, component developers, AI, data fusion, cybersecurity, wireless communications and localisation.

Growing internationally with Enterprise Europe Network (EEN)

AMANDA project is now officially in EEN (Enterprise Europe Network) the largest online database of business opportunities! The Enterprise Europe Network helps businesses innovate and grow on an international scale. It is the world's largest support network for small and medium-sized enterprises (SMEs) with global ambitions. The Network is active worldwide and brings together experts from member organisations renowned for their excellence in business support.

enterprise europe network
Business Support on Your Doorstep

The EEN helps AMANDA find the right international partners to grow, access new markets and distribute proposed solution. Indeed, the cooperation with the EEN organisation has opened new doors for us, we have gained new business contacts and proposals, and we are looking forward to the successful collaborations and results that are sure to come.

New conference publication
IEEE SAS 2021

2021 IEEE SENSORS APPLICATIONS SYMPOSIUM
AUGUST 23-25, 2021 | VIRTUAL CONFERENCE

A conference publication on AMANDA was submitted in April 2021 and accepted for publication on the IEEE Sensors Applications Symposium 2021 (SAS 2021) that was held from 23rd to 25th August. Alexis Papaioannou, a researcher from CERTH, attended the symposium, presenting the paper "A low-power fire monitoring and detection system on embedded systems using a Multilayer perceptron".

Call for papers has resulted in submissions from 30 countries and over 350 co-authors representing academia, industry, NGOs and government. Each submission was carefully peer-reviewed by a set of international experts, resulting in 68 accepted papers to be presented in regular and special sessions. We are proud that the paper on AMANDA was chosen and got the opportunity to be presented at this year's conference.

2ND AMANDA EXTERNAL ADVISORY BOARD MEETING

The second External Advisory Board (EAB) meeting took place virtually on 07 October 2021, and the AMANDA Consortium was delighted to welcome all Advisory Board members. This online meeting offered an opportunity to present the project and share progress to date with all participants.

The second EAB meeting focused on activities implemented since the first meeting held in June last year and activities foreseen in the forthcoming period. Dr Charis Kouzinopoulos, on behalf of CERTH, opened the meeting by presenting current project status, milestones completed and project achievements. This was followed by presentations from all project partners with the main topics of developments on the sensors included in the AMANDA card, rechargeable storage element and energy harvester, short- and long-range communication, localisation, and energy assessment. The final version of the unconstrained prototype and planning for the miniaturised prototype was discussed in detail, followed by a final presentation on dissemination and exploitation planning.

Members of the External Advisory Board expressed their strong support of AMANDA in general and expressed their satisfaction with the progress made regarding most activities. The EAB meeting was very productive and insightful, and many valuable comments and feedback were collected.

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INSIGHTS FROM THE 6TH PLENARY MEETING

Due to the ongoing health crisis, the 6th AMANDA Plenary Meeting was held virtually on 02 November 2021. WP leaders presented the progress of ongoing WPs, upcoming tasks and measures required.

The topics considered to be a priority and to which special attention will be paid during the upcoming period were discussed, in particular progress of the miniaturised prototype integration, prototypes finalisation and energy requirements, software implementation and optimisation, validation and evaluation of the ASSC. The Consortium joined together also to plan and design the next steps in disseminating and exploiting the project.

After discussing the current project status, AMANDA partners had a talk about the preparation for the 3rd Review Meeting. The next Plenary Meetings are planned in February and May 2022 in-person or hybrid if the circumstances with pandemic allow.

WEBINAR ON THE AMANDA AUTONOMOUS SMART SENSING CARD

On 07 December 2021, the second webinar out of the series of webinars called "AMANDA – Autonomous Smart Sensing Card (ASSC)" was successfully held.

The webinar was opened with an introductory speech and welcome by Dr Charis Kouzinopoulos (CERTH), who explained the AMANDA concept and our motivation, showed the main hardware and software components and wireless communication capabilities of the ASSC. In the presentation that followed, Dr Denis Pasero (ILIKA) showcased the three use cases identified in the AMANDA project and six scenarios that make optimal use of all the functionalities from the AMANDA card in its three versions – indoor, outdoor and wearable. Dr Martin Schellenberg (MICRODUL AG) focused on the successful development of ultra-low-power temperature sensor and thermal comfort monitoring scenario where the MS1089 temperature sensor plays a crucial role.

Dr Julien Campos (LIGHTRICITY) presented the last topic - Photovoltaic energy harvester component for miniature IoT devices, i.e. sustainable, environmentally friendly component and system that eliminate the need for battery replacements.

For all who were not able to attend the 2nd AMANDA webinar, the recording is available here.

EFECS 2021

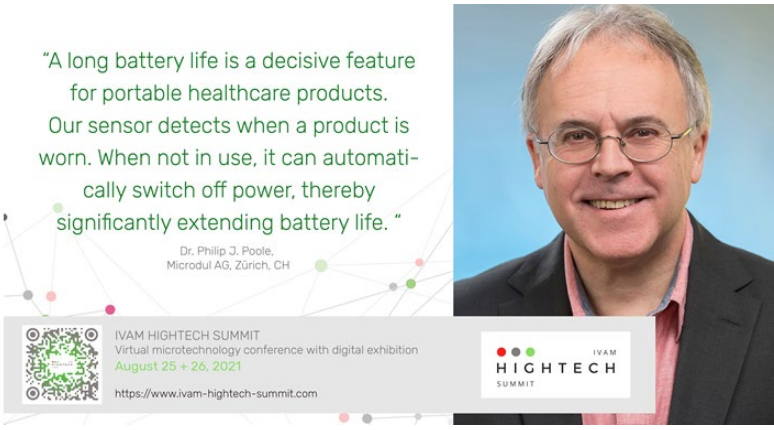
European Forum for Electronic Components and Systems

At this year EFECS 2021 exhibition, the AMANDA project applied for the virtual booth, and it was undoubtedly a great opportunity to network with running innovative projects and SMEs.

EFECS is the international forum focusing on "Our Digital Future" for a green and competitive Europe along the Electronic Components and Systems value chain in Europe. Therefore, the organisers of this event, AENEAS, EPoSS and Inside and in association with ECSEL Joint Undertaking, the European Commission and EUREKA have joined forces to bring all stakeholders together on 23-25 November 2021 online, where they discover, network, learn and shape "Our Digital Future" and how to manage the ECS impact for a green transition of digitalisation. During the event, there were opportunities to pitch concrete project ideas, investigate the interest in international collaborative projects, and participate in workshops and matchmaking programmes.

IVAM Hightech Summit 2021

The IVAM Hightech Summit took place as a virtual event on 25 and 26 August 2021, and it was an exceptional industry meeting of the international microtechnology scene showing trends and future markets. International experts from micro and nanotechnology come together once a year and present the latest developments, products and discuss the challenges of digitalisation, which has been the essential theme of the conference in recent years.



This year, Dr Philip J. Poole from Microdul AG gave the talk and presentation on Human Body Detection & Temperature Monitoring – Saving Wearable System Power on 25 August. Dr Philip J. Poole provided insight into the benefits of advanced and customised microelectronics that Microdul produces. Their expertise covers all process steps from development to engineering to production and test of custom applications. During this talk, the AMANDA project was presented and possible applications – use cases, that could significantly impact building automation, smart cities, smart agriculture, wearables, industrial IoT, health and human body condition monitoring. In the AMANDA project, Microdul developed a human body detector – an ultra-low-power capacitive sensor. Still, it does not just detect the body, now it can be used to wake up the system, which is necessary to keep the power low. Microdul also developed an ultra-low-power temperature sensor with zero standby current for project purposes.

SINDEX 2021 Trade Fair

SINDEX is the leading Swiss trade fair for industrial automation with the guiding theme "Innovation in dialogue". It was held onsite in Bern, Switzerland, from 31 August to 02 September 2021.
After the pandemic break, SINDEX was held hybrid, with an attractive supporting program on Sindex TV. On the first day of the fair, the main topic was "Cybersecurity", on the second day "Artificial Intelligence" and the third day "Predictive maintenance".

Microdul AG and AMANDA project were represented by Jörg Markwalder, CEO/Sales & Marketing Manager and Adrian Stalder, Sales Engineer. Although the SINDEX 2021 was significantly smaller than the previous one, the three-day trade fair on the BERNEXPO site gathered 120 exhibitors and more than 3,800 visitors. What are the main challenges faced by the project partners, possible applications of the AMANDA Autonomous Smart Sensing Card, the technology used, as well as the advantages over existing products on the market, are just some of the answers you could find out at the three-day trade fair.

SMART CITY EXPO WORLD CONGRESS 2021

AMANDA and Smart Eco Parking - expanding networks and creating synergies

PENTA, an AMANDA project partner, was participating as an exhibitor at Smart City Expo World Congress (SCEWC) that was held in Barcelona on 16-18 November 2021. It was an excellent opportunity and relevant event to showcase the AMANDA project, its goals, and use cases applicable to smart and sustainable cities, but also the collaboration with Smart Eco Parking - EU funded project. Smart Eco Parking sees the AMANDA card as one of the potential key components of intelligent transport solutions for urban and stationary traffic.

Special attention and the greatest interest of visitors had the AMANDA's ASSC solution for continuous occupancy monitoring in a parking lot.

Smart City Expo World Congress is the leading international event for the smart city sector, a key meeting point for experts and leaders of the world's most innovative cities, companies, research centres and international organisations. This year the conference was a hybrid event with a full day of broadcast events, workshops, panel discussion and side sessions that were also streamed virtually. The SCEWC marked its 10th anniversary and focused on COVID-19 recovery by exploring key themes such as enabling technologies, energy, environment, inclusion, infrastructure, governance, and others.

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SMART ECO PARKING

UPCOMING EVENTS IN 2022

Intertraffic Amsterdam, 29 March – 01 April 2022 (Amsterdam, Netherlands)
MD&M West, 12-14 April 2022 (Anaheim, California)
MedtecLIVE, 03-05 May 2022 (Stuttgart, Germany)
IT-TRANS, 10-12 May 2022 (Karlsruhe, Germany)
Sensor + Test 2022, 10-12 May 2022 (Nürnberg, Germany)
microTEC Südwest Clusterkonferenz, 18-19 May 2022 (Freiburg, Germany)
3rd AMANDA Webinar, May 2022 (Online, Zoom Webinar)
Swiss Medtech Day, 14 June 2022 (Bern, Switzerland)

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CONTACT

https://amanda-project.eu
amanda@amanda-project.eu

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