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CENTRE FOR
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# RESEARCH - TECHNOLOGY - INNOVATION
# FOR SUSTAINABLE GROWTH


## Next-gen microgrids

The innovative OptiMEMS software framework of CERTH|ITI wins the second prize in “Greenathon-Beyond Green Technologies” 2021

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# “Greenathon-Beyond Green Technologies” 2021: **The innovative OptiMEMS software framework of CERTH|ITI wins the second prize**

The innovative OptiMEMS software framework from the Information Technology Institute (ITI) of the Centre for Research and Technology - Hellas (CERTH) won the second prize - among more than 100 submitted proposals - in the panhellenic competition for green innovation "Greenathon" 20 organised by the Secretariat for Natural Environment and Water of the Ministry of Environment and Energy and the Organization for Natural Environment and Climate Change. The Greenathon finals took place on September 12, 2021 at the 85th Thessaloniki International Fair, where Angelina Bintoudi, research associate of CERTH/ITI and PhD candidate of the Aristotle University of Thessaloniki, represented the OptiMEMS team and competed with 12 teams.


The development team of OptiMEMS : Lambros Zyglakis, Angelina Bidoudi, Dimosthenis Ioannidis, Napoleon Bezas, Christos Timblalexis

The OptiMEMS framework is the brain for the building blocks of the future Smart Grid. The congested electrical distribution network now requires smart solutions to increase the rate of integration of renewable energy sources. Microgrids have been identified as a promising solution in this direction, since they are fully controlled, autonomous entities that generate, store and consume electricity either interconnected or not from the main distribution grid. In this context, a team of CERTH/ITI engineers developed the OptiMEMS framework, which was designed as a holistic automatic controller for the new generation microgrids. It is a complete solution for the optimal energy management of a microgrid, including production and storage units, electric vehicles and controllable smart loads.

OptiMEMS is also complemented by a fully customizable per-application web-based user-friendly interface through which users can visualise every technical and economic aspect of the microgrid operation.

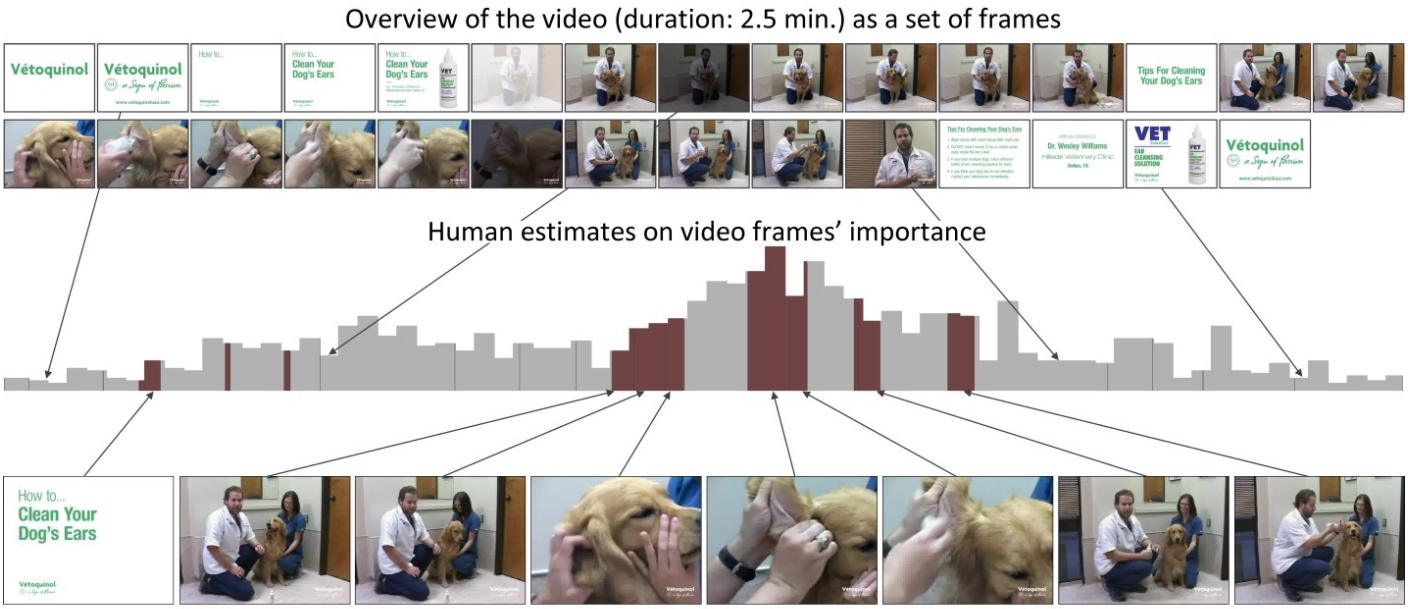
The developed framework integrates seamlessly different heterogeneous technologies such as optimisation techniques, machine learning, deep learning, dynamic simulations, open protocols (e.g. OpenADR, OCPP), distributed meters and sensors incorporated in the larger IoT notion, visual analytics and custom hardware devices.

**“ Our goal is that the microgrid brain we created will not only improve the operation of the existing microgrid infrastructures, but will also have a key role in making microgrids cost-effective solutions for the decarbonization of homes, commercial and industrial buildings, communities and towns in the near future**

*“Essentially, for the team, the award was the impetus we needed to start thinking of ways to commercialize our technological solution. It provided a missing perspective regarding the necessity of such smart energy solutions. Our goal is that the microgrid brain we created will not only improve the operation of the existing microgrid infrastructures, but will also have a key role in making microgrids cost-effective solutions for the decarbonization of homes, commercial and industrial buildings, communities and towns in the near future”*, underlines Angelina Bintoudi, from the development team of OptiMEMS

For three years now, OptiMEMS has proved its highly profitable and environmentally-friendly performance through its application on the first interconnected microgrid in Greece, the ITI SmartHome, located in the CERTH premises. At the same time, OptiMEMS has been piloted in larger industrial building installations and at Smart City level to optimally operate V1G / V2G e-mobility infrastructure, thus making it a horizontal solution to the challenges of Smart Networks 2.0.

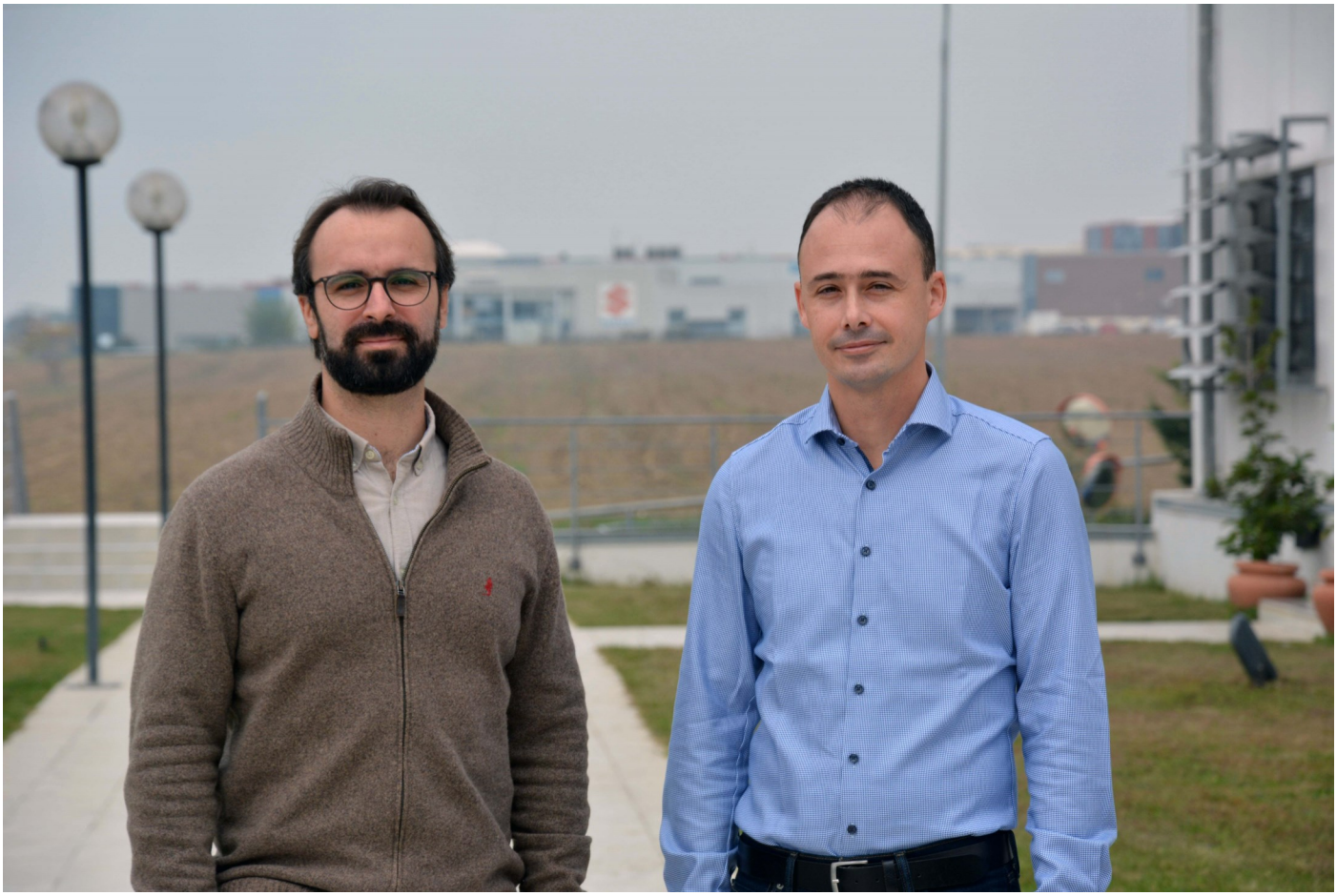
The development team of OptiMEMS consists of the following electrical and computer engineers: Angelina Bidoudi (idea conception, core machine implementation and technical manager), Lambros Zyglakis (backend engineer and installation manager), Christos Timblalexis (machine learning engineer) and Napoleon Bezas (machine learning engineer). The team is under the scientific supervision of Dr. Demosthenes Ioannidis, Researcher C 'of CERTH/ITI, who in collaboration with Dr. Dimitrios Tzovaras, Researcher Grade A’ of CERTH/ITI and Chairman of the Board of Directors of CERTH, are responsible for the commercial development of OptiMEMS. OptiMEMS was developed entirely by CERTH|ITI in the framework of the European research projects H2020 inteGRIDy, H2020 MEISTER, H2020 DELTA and ERA-NETMED 3DMicroGrid.




# Innovative Video Summarization Technologies

**On the recent advances on video summarization methods**, focuses the recently published work in the Proceedings of the IEEE, written by the researchers of the Intelligent Digital Transformation (IDT) Laboratory of the Information Technologies Institute (ITI) of CERTH, led by Dr. V. Mezaris in collaboration with Prof. I. Patras from Queen Mary University of London. These methods represent the current state of the art in the field, as they **perform significantly better than traditional approaches** that rely e.g., on data clustering.

Video summarization technologies aim to generate a short synopsis that conveys the important parts of the full-length video. Their application domain is wide and includes (but is not limited to) the use of these technologies by media organizations for effective management and promotion of their media assets, as well as by video sharing platforms to enhance viewers' engagement and increase content consumption.



The first author of the survey, Evlampios Apostolidis (left), research associate and doctoral candidate, and Dr. Vasileios Mezaris (right), head of the Intelligent Digital Transformation Laboratory.

Besides generating summaries that give a complete synopsis of the entire video and facilitate content search, video summarization can be tailored to the needs of particular content presentation scenarios, e.g. creating movie trailers or highlight videos of a sports event, creating concise educational materials, or creating video summaries with specific and/or notable events that were recorded over the last e.g. 24 hours by a surveillance or a wearable camera. Moreover, video summarization technologies can be combined with other methods to provide personalized versions of a video based on the interests of each viewer, video summaries that are adapted to the abilities of the users' devices (TV, smartphone, tablet), as well as multiple summaries of a 360-degree video that correspond to the different activities that took place simultaneously within the recorded area.

The researchers of the Intelligent Digital Transformation (IDT) Laboratory of the Information Technologies Institute (ITI), led by Dr. V. Mezaris, systematically work in the field of video summarization, in collaboration with Prof. I. Patras from Queen Mary University of London, and recently produced a comprehensive survey of the current bibliography. Their work, titled “Video Summarization Using Deep Neural Networks: A Survey”, was just published in the Proceedings of the IEEE (1). As the title implies, this work focuses on the recent advances on video summarization methods that utilize modern deep learning frameworks and architectures, such as Generative Adversarial Networks or Transformers, to learn how to estimate frames’ importance and build a video summary according to a targeted duration (Fig. 1). These methods represent the current state of the art in the field, as they perform significantly better than traditional approaches that rely e.g., on data clustering.

The published survey starts by formulating the video summarization task and discussing the characteristics of a typical deep-learning-based analysis pipeline. Then, it suggests a taxonomy of the existing algorithms and provides a systematic review of the literature that shows the evolution of the deep-learning-based video summarization technologies. Following, it reports on existing evaluation protocols and compares the performance of several approaches. Based on the outcomes of these comparisons, it indicates a set of potential future research directions to further advance the current state of the art in video summarization. According to the authors, “significant progress has already been made in the field of video summarization; however, several challenges need to be met for building solutions that are ready for practical application in the Media sector, by using more advanced deep learning methods and larger datasets for training and evaluation”.

(1) E. Apostolidis, E. Adamantidou, A. Metsai, V. Mezaris, I. Patras, "Video Summarization Using Deep Neural Networks: A Survey", Proceedings of the IEEE, vol. 109, no. 11, pp. 1838-1863, Nov. 2021. DOI:10.1109/JPROC.2021.3117472.

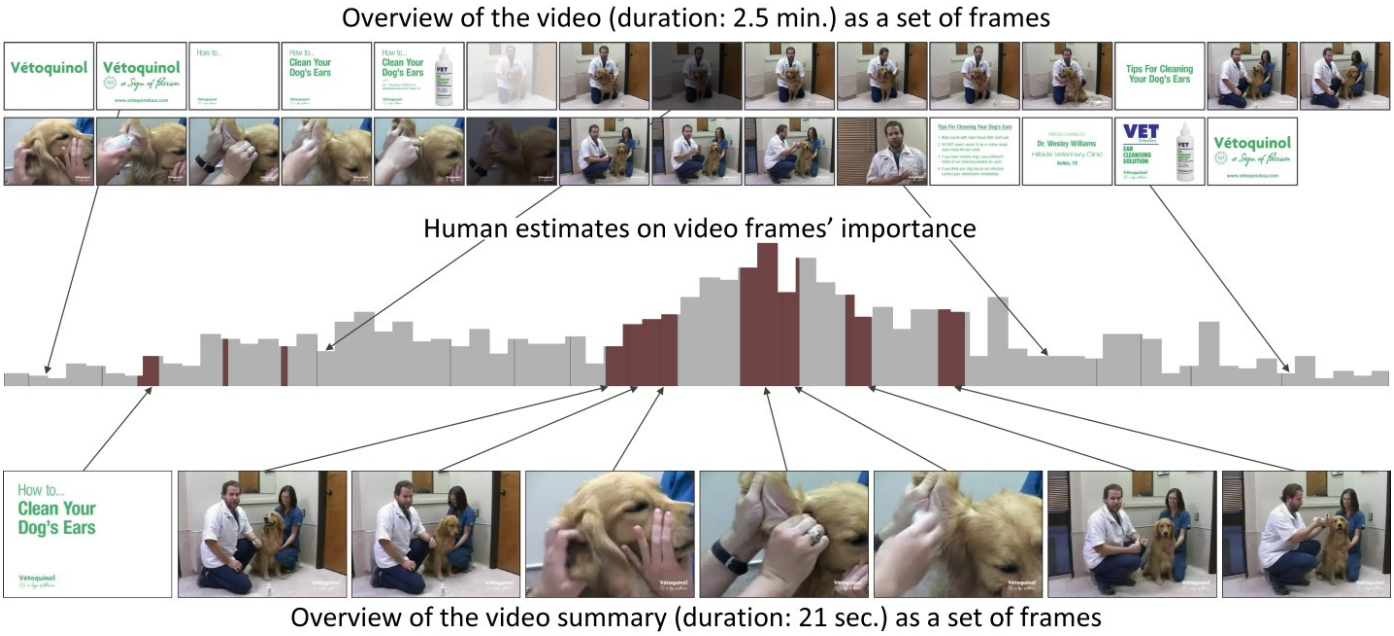



Fig.1 Top: Overview of a 2.5 min. video as a set of frames. Middle: Human estimates about the frames' importance (gray bars), and selected frames based on machine's estimates (coloured bars). Bottom: Overview of the created 21 sec. video summary as a set of frames (video source: TVSum dataset).

This work was partially supported by the EU Horizon 2020 ReTV (G.A.: H2020-780656, retv-project.eu) and AI4Media (G.A.: H2020-951911, ai4media.eu) projects. ReTV is a recently completed project that combined content and audience metrics and developed solutions to support publishing to all channels (Web, social, TV) "with the effort of one". Video summarization facilitated the production of different summarized versions of a given media item, according to the needs of the targeted audience and the characteristics of the utilized distribution channel. AI4Media recently entered the second year of its life (four years in total) and aims to deliver the next generation of ethical and trustworthy AI to serve the Media sector. In AI4Media our video summarization technologies are adapted and extended for being effectively applied on various new types of video content, such as movies and TV series.

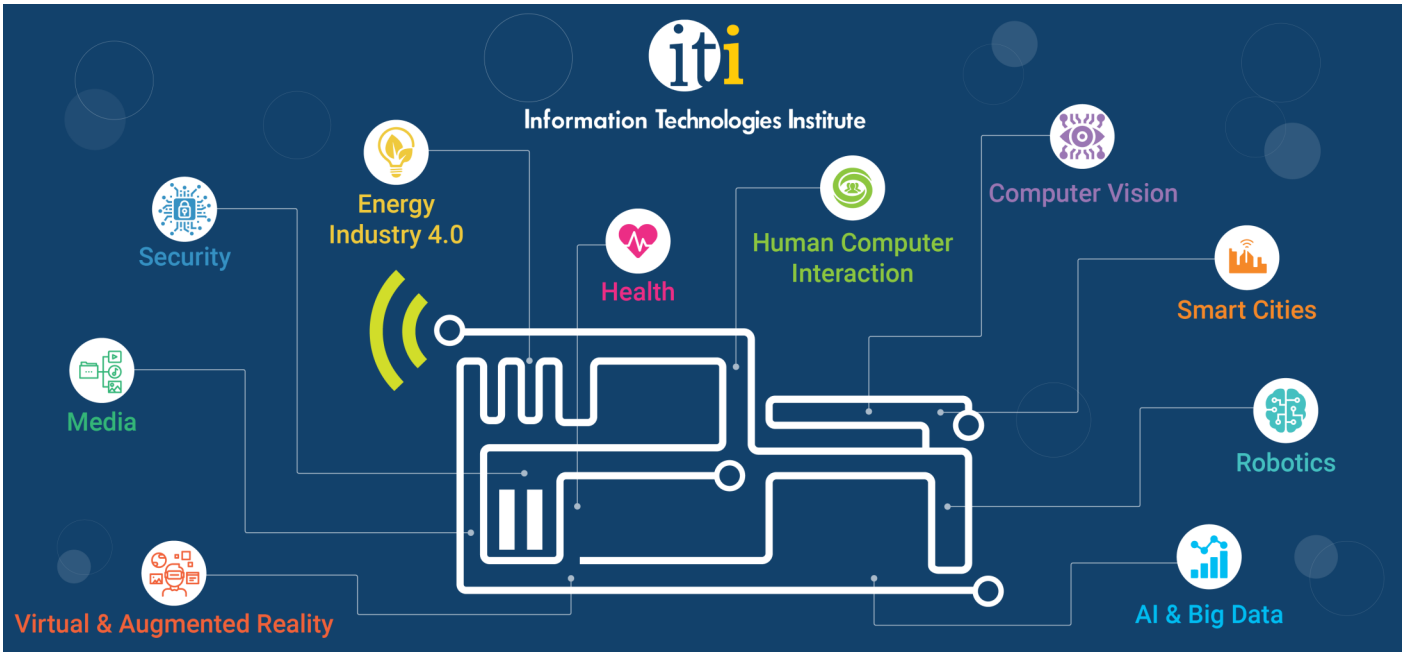
Dr. Kompatsiaris's research interests include AI/Machine Learning for multimedia analysis, Semantics (multimedia ontologies and reasoning), Social Media and Big Data Analytics, Multimodal and Sensors Data Analysis, Human Computer Interfaces, e- Health, Arts and Cultural, Media/Journalism, Environmental and Security applications.

# **New Director** at the Information Technologies Institute of CERTH

Dr. Ioannis Kompatsiaris, Researcher Grade A' at the Information Technologies Institute (ITI) of the Centre for Research and Technology Hellas (CERTH) assumed on October 1st his duties as new Director of the Institute. He was elected on this position 16 July 2021, by a 7-member Evaluation Committee that was appointed and supervised by General Secretariat for Research and Innovation (GSRI) of the Greek Ministry of Development and Investment.

**Short CV**

Dr Ioannis Kompatsiaris received the Diploma degree in electrical engineering and the Ph.D. degree in 3-D model based image sequence coding from the Aristotle University of Thessaloniki, Greece, in 1996 and 2001, respectively. He was elected as Researcher Grade D' in CERTH/ITI and following all intermediate Researcher Grades has been a Researcher A' (Research Director) at CERTH/ITI since 2013




Research directions of the Information Technologies Institute (ITI) of CERTH

He has been appointed as the Deputy Director of the Institute since January 2014 and he is the Head of the Multimedia, Knowledge and Social Media Analytics Lab (MKLab), which he founded in 2007.

His research interests include AI/Machine Learning for multimedia analysis, Semantics (multimedia ontologies and reasoning), Social Media and Big Data Analytics, Multimodal and Sensors Data Analysis, Human Computer Interfaces, e- Health, Arts and Cultural, Media/ Journalism, Environmental and Security applications. He is the co-author of 178 papers in refereed journals, 63 book chapters, 8 patents and 560 papers in international conferences. Google Scholar reports over 14000 citations with an h-index=56.

He has participated in 103 National and European research programs, in 31 of which he has been the Project Coordinator. He has also been the PI in 15 contracts from the industry. He currently coordinates the 30-institution AI4MEDIA Network of Excellence: A European Excellence Centre for Media, Society and Democracy for promoting Artificial Intelligence research, technologies and applications in Media with emphasis on ethical and trustworthy AI.

He has been the co-chair of various international conferences and workshops including the 13$^{th}$ IEEE Image, Video, and Multidimensional Signal Processing (IVMSP 2018) Workshop and has served as a regular reviewer, associate and guest editor for a number of journals and conferences currently being an associate editor of IEEE Transactions on Image Processing. He will be a General Co-Chair of ICMR2023, which will take place in Thessaloniki. He is a member of the National Ethics and Technoethics Committee, the Scientific Advisory Board of the CHIST-ERA funding programme and an elected member of the IEEE Image, Video and Multidimensional Signal Processing - Technical Committee (IVMSP - TC). He is a Senior Member of IEEE and ACM. Since January 2014, he is a co-founder of the Infalia private company, a high-tech SME focusing on data intensive web services and applications.


Researchers from CERTH, tha participated in Chat Lab meetings

# Chat Lab 2021: More than 2000 people chatted with researchers!

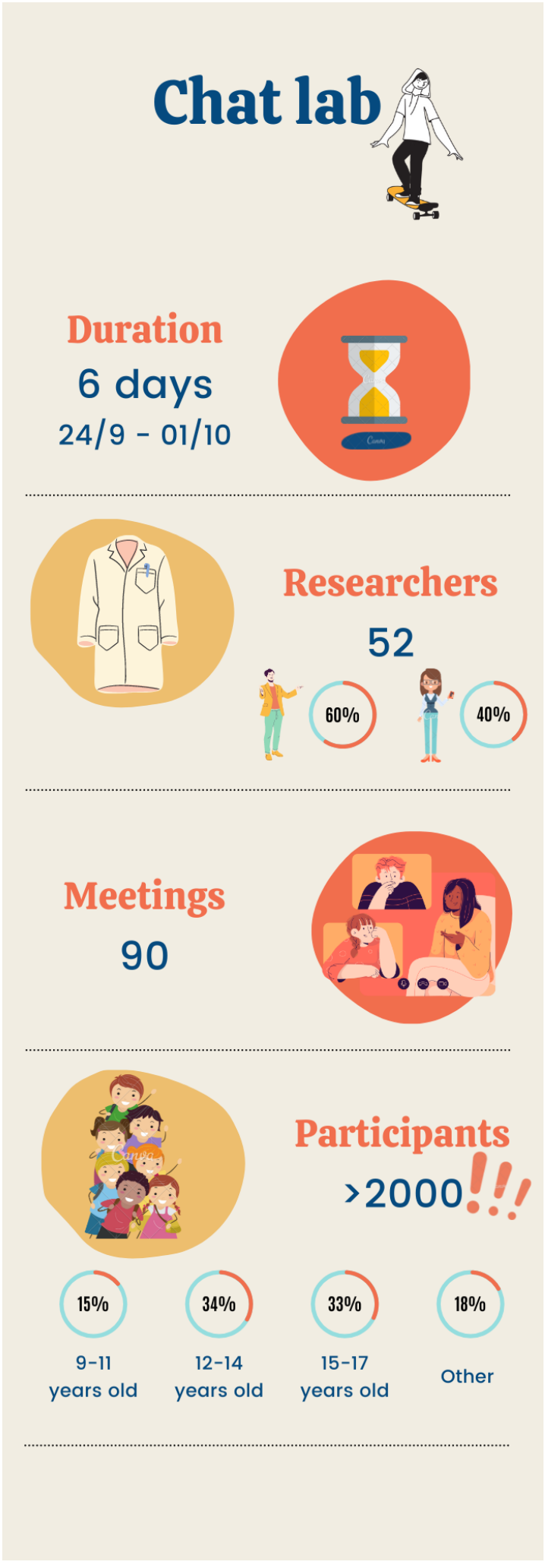
For a second consecutive year, **Chat Lab meetings** were organized with great success in the framework of the Researchers' Night initiative. Chat lab meetings which have been coordinated by the Centre for Research and Technology Hellas, are short, online discussions between researchers and the public. In a six day-period, **90 meetings have taken place with 33 different researchers,** while participants were mainly schools from all over Greece – from Komotini to Crete.

For a second consecutive year, Chat Lab meetings were organized with great success in the framework of the Researchers' Night initiative. Chat lab meetings which have been an inspiration of the Centre for Research and Technology Hellas, are short, online discussions between researchers and the public. Specifically, 52 researchers from eight different research centres and universities volunteered for the activity and were available for online meetings. Four of them worked and resided in research organisations abroad.

In a six day-period, 90 meetings have taken place with 33 different researchers, while participants were mainly schools from all over Greece – from Komotini to Crete. In total, Chat Lab 2021 attracted more than 2000 people (mostly school students) who talked directly to researchers, became familiar with research and understood its importance to our everyday lives.

The action aimed to provide reliable answers to the public's questions and concerns in hot scientific topics such as Artificial Intelligence, Health, Environment, Urban Transportation, Agrotechnology and Smart Farming.

Researchers mainly from the Centre for Research and Technology Hellas, the Foundation for Research and Technology Hellas, the University of Patras, the University of Thessaly, the Hellenic Mediterranean University and the National Technical University of Athens offered to the public the opportunity to view science through the eyes of their closest representatives.



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The **Centre for Research and Technology-Hellas (CERTH)** founded in 2000 is one of the leading research centres in Greece and listed among the TOP-15 E.U. institutions with the highest participation in competitive research grants.

Today CERTH includes the following five institutes with indicated major fields of research:

- **Chemical Process and Energy Resources Institute (CPERI)** Sustainable & Clean Energy, Environmental Technologies, Chemical & Biochemical Processes, New Functional Materials
- **Information Technologies Institute (ITI)** Informatics, Telematics and Telecommunication Technologies, Safety and Security
- **Hellenic Institute of Transport (HIT)** Smart Sustainable Mobility, Transport Safety
- **Institute of Applied Biosciences (INAB)** Agri-biotechnology, Health Translational Research, Informatics for big bio-data
- **Institute for Bio-Economy and Agri-Technology (IBO)** Bio-economy, Agri-technology

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