ILI GLOW

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TU/e Technische Universiteit **Eindhoven** University of Technology

OpenAIS Pilot in De Witte Dame

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The OpenAIS[1] project aims at developing a standard for inclusion of modern LED office lighting into the Internet of Things era. In this way, all the luminaires – with integrated presence and light level sensors – in buildings, are directly connected to the Internet as an IP end-node, allowing for control of individual luminaires from anywhere, using any "Thing". This enables a transition from the currently existing closed and command oriented lighting control systems to an open and service-oriented lighting system architecture.

The vision of the research project is to create an open ecosystem of suppliers of interoperable components and a market for apps and services that exploit the lighting system to add value beyond the lighting function and allow easy adaptability to cater for the diversity of people and demands. Added value can be related to more efficient use of the building, reduction of energy consumption, and increased comfort and wellbeing.

The project brings together a collaboration of the leading lighting companies Zumtobel, Tridonic, and Philips Lighting and the major players in IoT technology ARM and NXP. Consortium partners Dynniq and Johnson Controls represent the installer and the end user. Academic knowledge on system architecture, integration, and user interaction is added by TU/e-ILI and TNO-ESI.

After 2.5 years, a new system architecture is proposed and integration of new hardware components is at full speed. ILI contributed in particular to the development of efficient unicast and multicast wireless communication solutions; referring to addressing a single end-node, and to addressing a group of end nodes all at once respectively. The demands for lighting are high: not only individual luminaires need to be controlled, but often many luminaires need to immediately respond to a single command in a synchronized way.
The OpenAIS design will be validated by a pilot installation in the office of the GGD Brabant-Zuidoost at the 5th floor in the "Witte Dame" (White Lady) building in Eindhoven. This building is a former Philips factory built in 1930 in which light bulbs were made. Renovated by the City of Eindhoven it is now a national industrial monument and in daily use as offices. Other parts of the building house a restaurant, shops, the famous Design Academy and the Public Library.

In the last quarter of 2017, 400 LED luminaires of multiple manufacturers, will be installed for a 5-month trial period starting January 2018. GGD can look forward to energy savings, enhanced lighting comfort, and personal controls using apps and dedicated interfaces.

After preliminary studies in TU/e's office labs, ILI will install newly designed user interfaces and personal applications in the OpenAIS pilot installation. The goal is to investigate the opportunities and challenges of personal control for office lighting. Often, personal control in an office is seen as being able to change the light settings of all luminaires individually. But this seems easier than it is: multiple people can interact at the same time, and interactions can change (carefully) selected light settings of others.

Examples of three different interfaces for a shared lighting system that ILI has recently investigated are: (A) an individual smart phone application; (B) a set of distributed remote-like pointer interfaces; and (C) a centrally attached tangible wall interface with tangible tokens.

The pilot at the GGD is a great way of demonstrating and evaluating the newly developed concepts for system architecture and user interaction. One of the next projects for ILI is the installation and actual usage of a similar connected lighting system from September 2018 onwards in the renovated Atlas building at the TU/e campus.

1. Open Architectures for Intelligent Solid State Lighting Systems. For more information see: www.openais.eu.

The Internet of Lighting: download and play!

Interview | Walter Werner interviewed by Michiel de Boer of Moesasji

“It was around 1996 that we at Zumtobel received the first request to connect luminaires to the Internet. Back then it was totally out of reach. It is coming close now,” says Walter Werner. The past three years, Werner led the architecture team of the European research project OpenAIS. “I am happy to say we have created an architecture that allows for various types of lighting control, with each single node connected to the Internet.”

OpenAIS is an EU-co-funded Horizon 2020 research project, aiming at setting the leading standard for inclusion of professional lighting applications into IoT, with a focus on office lighting. The project brings together a strong collaboration of the leading lighting companies Zumtobel, Tridonic, and Philips, and the major players in Internet of Things-technology ARM, NXP and Dynniq (formerly Imtech). Consortium partner Johnson Controls represents the end-user, and academic knowledge on ICT and system architecture is present through TU/e and TNO-ESI.

Control and atmosphere

Werner: “Internet of Things is all about controls and data, whereas lighting is all about providing an environment and atmosphere. Up till today there was no way to bring these worlds together. OpenAIS was tasked to create and showcase that IoT can be used to provide lighting controls in more or less the same quality as heritage lighting controls, adding the benefits of the internet.
We faced quite a challenge. Internet communication is strictly working one-to-one. If you look up a webpage on your cell phone, it talks to a single server. Of course the Internet has many servers, but the communication is to each individually. With lighting, you want to be able to switch or dim a (large) group of lights at once. To serve lighting best, we had to create group communication that is based on multicast technology.
Furthermore we had to cover security, because multicast doesn’t support that standardly. We also looked into the negotiation aspect of Internet communications. Again, if you request a webpage on your phone, it will negotiate with the cell tower how to transfer the page (e.g. LTE or 4G) and with the server in what browser and what resolution. Only after this is arranged, the data stream is created to serve the device best. You have to make sure your architecture works on all these levels.
So we worked hard to tackle all the aspects and I think we have covered most of them in a very future-oriented and decent way. We have developed an architecture with building blocks that allows the vendor to build precisely the application he desires. It is like building a bridge: Is it small or large? How much pillars do you need in between? Or should you make a suspension? The range of applicability is as wide as possible but still the architecture gives the rules to achieve interoperability, making sure that it works in the end, across vendors, and that it provides what you want. I am happy that we were able, with experts of so many different companies, to create a common view and common document for a future-oriented architecture. I think that is unique!”

“I am happy to say we have created an architecture that allows for various types of lighting control, with each single node connected to the Internet.”

Enabler

Are we ready then for the Internet of Lighting? Werner: “We are progressing steadily. The architecture is published, as well as a database with examples on how to use it. This is open to the public. But in the end we will have to see, if, and when the market, the lighting community, will pick it up. Our approach and architecture have to gain awareness and recognition first. In January 2018 we will showcase our demonstrator. In the Witte Dame in Eindhoven we will feature a project of considerable scale: Some 400 luminaires and 400 sensors, all together more than 1200 functional points, will be controlled in multiple groups over the internet. It is a decent large deployment of both wired and wireless connections, working seamlessly together, including building management integration. The functionality will be alike to what heritage lighting control can do: scenes, switching, dimming and regulations, but strictly based on internet communication to the final node.”

Play

What will change by IoL? Werner: “The main development I see is, we can disconnect controls, business and development from the luminaires business. Let me clarify: If I was an engineer that wanted to develop a very specific kind of control, for example a system that follows persons with a spot light, this would be a very specific case for a lighting manufacturer. They rather focus on standard hard- and software, that is industrially efficient, easy to install, to maintain and so on. Today, you are either large enough to build, market and sell your own complete system, or you can forget it. But with IoT you could sell the controls algorithms only, and this way add a specific expertise to the standard offer. You can make it available on top of existing luminaires, you can even place your controls in the cloud and connect them to all systems that are interested in using it. That’s what Internet provides. Today’s lock-in into larger organizations or standardized technology is gone. IoL provides a completely different way of achieving variety in lighting systems, and it surely will boost ideas we can’t even think of at this moment. We will have an AppStore for lighting controls in the future. Just download and play!”