Beyond the switch: explicit and implicit interaction with light

Beyond the Switch: Explicit and Implicit Interaction with Light

Dzmitry Aliakseyeu
Philips Research Europe
Eindhoven, The Netherlands
dzmitry.aliakseyeu@philips.com

Andrés Lucero
University of Southern Denmark
Kolding, Denmark
lucero@acm.org

Bernt Meerbeek
Philips Research Europe
Eindhoven, The Netherlands
bernt.meerbeek@philips.com

Tanir Ozcelebi
Eindhoven University of Technology
Eindhoven, The Netherlands
t.ozcelebi@tue.nl

Jon Mason
Philips Research Europe
Eindhoven, The Netherlands
jon.mason@philips.com

Henrika Pihlajaniemi
University of Oulu, Faculty of Architecture
Oulu, Finland
henrika.pihlajaniemi@oulu.fi

NordiCHI '14 , Oct 26-30 2014, Helsinki, Finland
ACM 978-1-4503-2542-4/14/10.
http://dx.doi.org/10.1145/2639189.2654826

Abstract
The commercial introduction of connected lighting that can be integrated with sensors and other devices is opening up new possibilities in creating responsive and intelligent environments. The role of lighting in such systems goes beyond simply functional illumination. In part due to the large and established lighting network, and with the advent of the LED, new types of lighting output are now possible. However, the current approach for controlling such systems is to simply replace the light switch with a somewhat more sophisticated smartphone-based remote control. The focus of this workshop is to explore new ways of interacting with light where lighting can not only be switched on or off, but is an intelligent system embedded in the environment capable of creating a variety of effects. The connectivity between multiple systems and other ecosystems, for example when transitioning from your home, to your car and to your office, will also be explored during this workshop as a part of a connected lifestyle between different contexts.

Author Keywords
Connected lighting; lighting control; user experience

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction

LED based lighting is versatile in creating static and dynamic light effects that were not possible with traditional lamp technologies. LED based light sources can be used as actuators for signaling events, to make people feel better, or to transmit data. The compact form of LEDs means they can be packaged into new form factors and used in areas that were previously unsuitable for lighting such as in the floor or embedded into a building's architecture. When combined with security and awareness systems, signage can appear and disappear when needed.

In terms of control the most common approach is to replace a light switch with a smartphone based app that offers extended control over lighting (for example Philips hue, LIFX, etc.). We however, believe that in many situations the UI will need to be intelligent and sensitive to the context and responsive to the people so as to maximize the potential of these new systems. The effort required to obtain the reward of beautiful and advanced lighting needs to be balanced carefully.

One possible direction is to enrich lighting systems with sensor networks thus enabling intelligent and autonomous lighting control based on contextual or implicit user information. Often these networks are an integral part of a smart ecosystem, which also includes other devices. In such systems lighting can play different roles in addition to functional lighting. For example, the Philips Hue lamps can be linked with IFTTT (If This Then That), which is a simple end user programming service that enables people to connect lighting to web-based media. In this way, the hallway light might turn blue if rain is forecast for that day to remind the user to take an umbrella in the morning.

Currently, lighting has so much more to offer us but at a potential cost of increased complexity in terms of control and understanding. New and richer ways of interacting with light will be required, ones that clearly communicate the status of the system and enables control on multiple levels from commissioning to daily use [5]. This may require multiple interaction technologies to work alongside one another such as tangible, multi-touch, or gesture-based user interfaces combined with implicit sensor and rule based interactions.

In two previous workshops [1, 2], the domain of interactive lighting was outlined and our initial vision was formulated. Several core topics were identified for this research area: semantics of light; light applications and technology; multi-user; and interaction paradigms. During a third workshop at CHI2013 [3], we changed scale and went outside to look into interactive urban lighting. In this workshop at NordiCHI, we would like to explore novel and rich ways to explicitly and implicitly interact with light in different indoor contexts (e.g., home, car, office, hospital). We chose NordiCHI due to the special relationship that people from Nordic countries have with light (i.e., midnight sun, polar night, aurora borealis), which we hope will give us new insights into how light is used and interacted with.

Goals of the Workshop

The focus of this workshop is to explore new ways of interacting with light, ones where we look beyond switching indoor lighting on or off, where lighting becomes an intelligent system embedded in the environment, capable of creating a variety of effects, and where lighting is an integral part of a larger ecosystem of smart and connected devices.

Our aim is to identify key UI interaction paradigms for these new intelligent lighting systems, as well as methodologies to evaluate them. We are particularly interested in:

- *Exploring new opportunities and challenges that arise when light sources are embedded in an environment both physically and on the system level*. What if your wall, your rug, or your coffee mug is the light source? What would be the best way to interact with the light?
- *Connectivity between multiple systems and other ecosystems resulting in a connected lifestyle including multiple contexts and transitions*. For example, what if you are moving from your home to your car to your office? What will happen with the lighting and the way you control it?
- *Identifying the optimum balance between internal system control and user control, as the complexity and the flexibility of new light systems will require at least a partial automation* [4]. The challenge here is to identify which situations or for which users should one use explicit or implicit interaction technologies, or perhaps a combination of both?

Workshop Plan

The aim is to bring together researchers and practitioners from disciplines such as interaction design, user-centered design, human factors, lighting design, and human-computer interaction that are interested in exploring interaction with connected lighting systems in the context of smart indoor environments.

Before the Workshop
We will establish a dedicated website (http://lightingworkshop.wordpress.com) for announcements, communication, related work and accepted contributions. The call for participation will be sent to relevant groups of researchers and practitioners.

Soliciting and Selecting Contributions
Potential participants should submit a 2-4 page position paper describing their interest and/or previous work related to the topic of the workshop. We will select participants based on the quality and relevance of their paper. We will limit the size of the workshop to 12-18 people to ensure effective discussion. All selected papers will be published on the website.

During the Workshop
The first part of the workshop will be dedicated to the introduction of connected lighting and its integration in smart ecosystems and the presentations of the attendees. A list of topics for the afternoon session will also be prepared.

After successful 'hands on' sessions during our two last workshops at DIS [2] and CHI [3], where several working prototypes of interactive lighting systems were created, we will apply the same approach for this workshop but with greater emphasis on UI. In the afternoon session the attendees will be divided into groups, each with their own focal area. Each group will design a new concept for an interactive lighting system and create a simple prototype. For the prototyping we will use Arduino boards, DMX controllers and different light sources, as well as materials for paper prototyping. This activity will stimulate discussion on how to prototype and evaluate a connected and intelligent lighting concept.

Outcome of the workshop
The results of the workshop will be summarized and published on the workshop website. Depending on the maturity of the submissions and the outcome of the workshop we intend to write a special journal issue with the right publisher to promote this research area.

Organizers

The workshop organizers are all active researchers in the area of user interaction, light control and light perception specifically focusing on new forms of interaction and they have considerable experience in organizing workshops on similar topics.

Dzmitry Aliakseyeu is a senior scientist at Philips Research. Prior to this he has held a position of Assistant Professor at the Industrial Design department of the Eindhoven University of Technology. His research interests lie in the areas of user interaction with lighting and smart lighting systems.

Bernt Meerbeek is a senior scientist at Philips Research in Eindhoven. He holds a Professional Doctorate in Engineering on User-System Interaction from Eindhoven University of Technology. His research interests are in user interaction solutions for intelligent systems, ranging from smart consumer appliances to smart environments and lighting systems.

Jon Mason is a senior scientist at Philips Research in Eindhoven. His work at Philips has included the design of new user interaction means for lighting in the retail, office and hospitality contexts. His interests include UI design, design methodology, and the inclusion of art in design.

Andrés Lucero is an associate professor of Interaction Design at the University of Southern Denmark. His interests lie in the areas of human-computer interaction, user-centered design, and design research.

Tanir Ozcelebi is an assistant professor of Computer Science at the System Architecture and Networking capacity group of Eindhoven University of Technology. His research interests are resource and service discovery and management, quality of service management and defining the system behavior for applications in smart distributed systems.

Henrika Pihlajaniemi is a researcher and university teacher in the University of Oulu, Faculty of Architecture. Her research and professional interests are in the design and experience of intelligent and adaptive lighting in both indoor and outdoor contexts. Currently, she is finalizing her PhD about adaptive lighting.

References

[1] Aliakseyeu, D., Mason, J., Meerbeek, B., van Essen, H., Offermans, S. The role of ambient intelligence in future lighting systems. In *Proc. Of AmI'11*, (2011)

[2] Aliakseyeu, D., Meerbeek, B., Mason, J., van Essen, H., Offermans, S., Wiethoff, A., Streitz, N., Lucero, A. Designing interactive lighting. In *Proc. of the DIS'12*, ACM, (2012), 801-802

[3] Aliakseyeu, D., van Essen, H., Lucero, A., Mason, J., Meerbeek, B., den Ouden, E., & Wiethoff, A. Interactive city lighting. In *CHI'13 Extended Abstracts*, ACM, (2013), 3191-3194.

[4] Bhardwaj, S., Ozcelebi, T., and Lukkien, J. Smart lighting using LED luminaries. In *proc. of PERCOM Workshops*, IEEE, 654 – 659, (2010).

[5] Lucero, A., Lashina, T., and Terken, J. Reducing Complexity of Interaction with Advanced Bathroom Lighting at Home*. I-COM 5,* 1 (2006), 34-40.