Communicating system behavior with ambient light

JADS Jheronimus Academy of Data Science

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

Communicating system behavior with ambient light

From complex control system behavior to ambient lighting patterns

DSCE DATA SCIENCE CENTER EINDHOVEN

Introduction

Smart technology has permeated our daily lives, domestic contexts and generally any transition between work, living and leisure imaginable. When such technology is integrated in living and practices of living, we encounter different forms of automation and sharing of tasks between the machine and humans. While we often strive for high degrees of automation in everyday chores, errands and periodic adjustments, the loss of control and being oblivious to how automation actually behaves in our personal spaces presents difficulties.

This poster outlines a research project on enhancing a smart automation system [2] with means to communicate about its internal dynamics and working principles using abstract light patterns that are created by distributed small lights in the context. For example, when the control system adjusts the room climate according to end-users' preferences, this process will take some time (heating air, decreasing humidity, etc.). By communicating this fact to end-users we can prevent overshooting in further adjustments, misguided troubleshooting and general impatience.

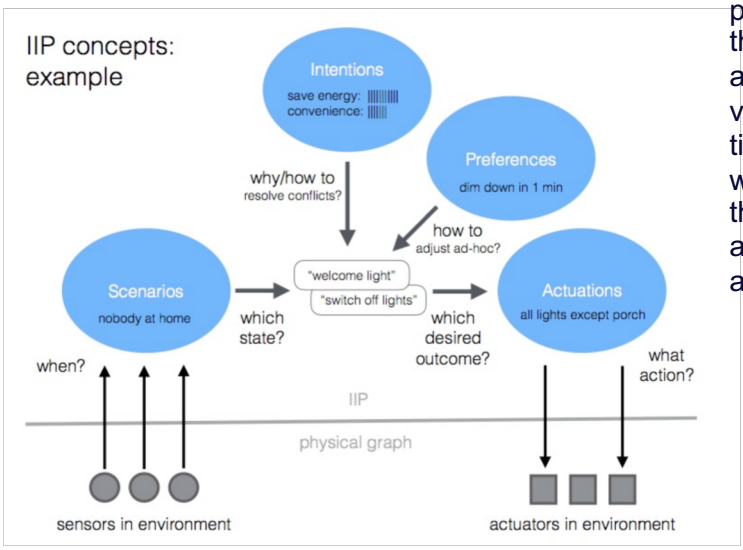

Figure 1. From left to right, conventional trigger-action rules, IIP concepts and behavior, and communication setup for ambient light patterns

Mapping system internals to patterns

Analyzing the internal processes of an **interactive** automation system, we can find more candidates for communication to end-users such as requests for user preferences, context switches of individual users, conflicts between automation and user preferences, conflicts between preferences of different users, and that the system cannot act upon the given context or information. Our hypothesis is that these cases can be communicated effectively using ambient lighting patterns and help resolve friction between human and the automation system.

Communicating with lighting patterns

In addition to the above mapping, we briefly explain the lighting design for communicating [1] a system's internals and initiating human-system interactions for achieving better user experience (cf. Figure 2). Before the system automatically acts, the system will (1) show blinking lights to notify the user of an action to be be executed in a few minutes. The user notices the lighting pattern and understands the notification. She (3a) is either not sure about the message and looks around to check the lighting patterns on other devices [back to 1]; (3b) approves the automation choice [go to 4b]; or (3c) disables automation on an input device (e.g. gesture or voice control) [go to 4c]. The system (4b) shows a timer or countdown to indicate when the function will be triggered; (4c) dimmed the lighting to confirm the function was disable. As a result, the user (5) is aware of automation choices being taken into account and feels in control.

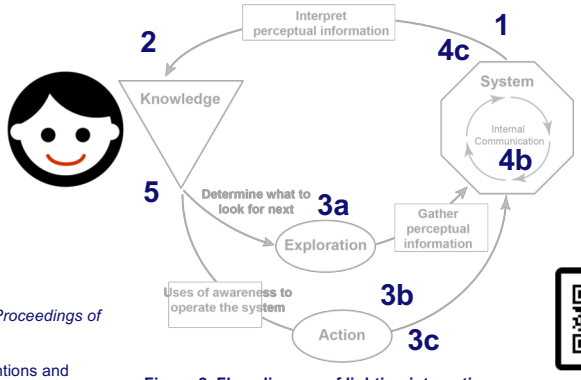

Figure 2. Flow diagram of lighting interaction.

Video of Ambient Lighting Patterns

[1] Chuang, Y., Chen, L.-L., & Liu, Y. (2018). Design vocabulary for human–IoT systems communication. In *Proceedings of the CHI Conference on Human Factors in Computing Systems* (No. 274). New York, NY: ACM. https://doi.org/10.1145/3173574.3173848

[2] Funk, M., Chen, L.-L., Yang, S.-W., & Chen, Y.-K. (2018). Addressing the need to capture scenarios, intentions and preferences: Interactive intentional programming in the smart home. *International Journal of Design,12*(1), 53-66.

Yaliang Chuang, Mathias Funk, and Lin-Lin Chen, Future Everyday group, Industrial Design, TU/e