

## Working Group 2, Milestone 2.2

# Development of OCC-VLC Positioning Systems

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## Introduction

In the NEWFOCUS working group 2, the optical wireless range was defined in the order of magnitude of meters. Consequently, the large majority of the work can be found in the realm of indoor environments. In the first year and a half of this project, multiple input documents created by the members of this action and publications acknowledging NEWFOCUS can be classified under the “Development of OCC-VLC Positioning Systems” umbrella.

Below, we have created an overview of the input documents and publications that fill within this classification.

## Input documents

- “Performance evaluation of VLC-based sensing and localization”, by Alexis Dowhuszko, Mehmet Ilter, Jyri Hämäläinen and Risto Wichman School of Electrical Engineering, Aalto University, Finland.
- “Impact of Transmitter Positioning and Orientation Uncertainty on RSS-based Visible Light Positioning”, by Neha Chaudhary, Luis Nero Alves, and Zabih Ghassemlooy; Instituto de Telecomunicações and Departamento de Electrónica, Telecomunicações e Informática, Universidade de Aveiro, 3810-193 Aveiro, Portugal; Optical Communications Research Group, Faculty of Engineering and Environment, Northumbria University, Newcastle upon Tyne NE1 8ST, U.K..
- “The Impact of Blocking and Shadowing on the Indoor Visible Light Positioning System” Othman Isam Younus, Neha Chaudhary, Zahra Nazari Chaleshtori, Zabih Ghassemlooy, Luis Nero Alves, and Stanislav Zvanovec; Optical Communications Research Group, Faculty of Engineering and Environment, Northumbria University, Newcastle upon Tyne NE1 8ST, U.K.; Instituto de Telecomunicações and Departamento de Electrónica, Telecomunicações e Informática, Universidade de Aveiro, 3810-193 Aveiro, Portugal; Department of Electromagnetic Field, Faculty of Electrical Engineering, Czech Technical University in Prague, Prague 16627, Czech Republic.
- “A Convolutional Neural Network-based Visible Light Positioning System using a Rolling Shutter Camera”; Neha Chaudhary, Cristo Jurado-Verdu, Pedro Fonseca, Luis Nero Alves, Rafael Perez-Jimenez and Zabih Ghassemlooy.
- “LiFi Positioning and Optimization in an Indoor Factory Environment” ;Ziyan Ma, Sepideh Mohammadi Kouhini, Christoph Kottke, Ronald Freund, Volker Jungnickel Marcel Müller, Daniel Behnke, / Fraunhofer Heinrich-Hertz-Institute, Weidmüller Group.

## Publications

- J. Bas, J. A. Ortega, M. Busquets and A. A. Dowhuszko, “Indoor monitoring system based on ARQ signaling generated by a Visible Light Communication link,” 2021 IEEE Global Communications Conference (GLOBECOM), Madrid, Spain, 2021, pp. 1-6, doi: 10.1109/GLOBECOM46510.2021.9685169.
- Chaudhary, N.; Younus, O.I.; Alves, L.N.; Ghassemlooy, Z.; Zvanovec, S.; Le-Minh, H. “An Indoor Visible Light Positioning System Using Tilted LEDs with High Accuracy”. *Sensors* 2021, 21, 920. <https://doi.org/10.3390/s21030920>
- N. Chaudhary, O. I. Younus, Z. Nazari Chaleshtori, L. N. Alves, Z. Ghassemlooy and S. Zvanovec, "A Visible Light Positioning System based on Support Vector Machines," 2021 IEEE 32nd Annual International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC), Helsinki, Finland, 2021, pp. 1-6, doi: 10.1109/PIMRC50174.2021.9569249.

- O. Isam Younus, N. Chaudhary, Z. Nazari Chaleshtori, Z. Ghassemlooy, L. Nero Alves and S. Zvanovec, “The Impact of Blocking and Shadowing on the Indoor Visible Light Positioning System,” 2021 IEEE 32nd Annual International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC), Helsinki, Finland, 2021, pp. 1-6, doi: 10.1109/PIMRC50174.2021.9569377.
- Umit Sen, Yalin Evrim Yesilirmak, Irem Ozgur Bayman, Taner Arsan, Erdal Panayirci, Nobby Stevens, “3D indoor positioning with spatial modulation for visible light communications,” Optics Communications, Volume 529, 2023, 129091, ISSN 0030-4018, <https://doi.org/10.1016/j.optcom.2022.129091>.
- J. De Bruycker, W. Raes, S. Zvanovec and N. Stevens, “Detection of Non-Line-of-Sight Contributions for Visible Light Positioning by Polarization,” 2022 IEEE Photonics Conference (IPC), Vancouver, BC, Canada, 2022, pp. 1-2, doi: 10.1109/IPC53466.2022.9975725.