



# **ENLIGHT'EM**

## European Training Network in Low-Energy Visible Light IoT Systems

Innovative Training Networks (ITN)  
H2020-MSCA-ITN-2018

### **Deliverable D4.1**

Annual report on training activities, presentation of the results of past events and detailed planning of upcoming events



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## Deliverable D4.1

### Annual report on training activities, presentation of the results of past events and detailed planning of upcoming events

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## **Abstract**

This document captures the first annual report on training activities, presentation of the results of past events and detailed planning of upcoming events of the ENLIGHT'EM project. The purpose of all these activities is the optimization of ESRs learning during their PhD programs, as well as the dissemination of knowledge in the project research field. This deliverable has been submitted with some delay with respect to the original plan, as the COVID-19 pandemic has affected the work of the supervisors of the training network.

## **Revision History**

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0.3	Borja Genovés	16/06/2020	Comments from Marco (TUD) addressed.
1.0	Domenico Giustiniano, Borja Genovés	26/06/2020	Final editorial work.



## Executive summary

This document captures the first annual report on training activities, presentation of the results of past events and detailed planning of upcoming events of the ENLIGHT'EM project. The purpose of all these activities is the optimization of ESRs learning during their PhD programs, as well as the dissemination of knowledge in the project research field.

Training Event 1 took place within the first year of the project, where ESRs received a training in the shape of a tutorial about foundation of Visible Light Communication (VLC) for low-power Internet-of-Things devices (IoT). Slides, videos and additional resources were obtained from this event as results. As only a few ESRs joined the project at the time of Event 1, the video has been recorded and is publicly available, so that ESRs, but also any researcher in the field, can use them at their convenience.

During the next year, an online seminar, the Training Event 2, Training Event 3 and Training Event 4 will take place, and its planning is detailed in this document.

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## List of Abbreviations

CDP: Career development plan

ENLIGHT'EM: European Training Network in Low-Energy Visible Light IoT Systems

ESR: Early-stage researcher

EWSN: International conference on embedded wireless systems and networks

IoT: Internet of Things

MSCA: Marie Skłodowska-Curie Actions

R&D: Research and Development

# **1. Introduction**

## **1.1. Scope and objectives**

This document contains the first annual report on training activities, results of past events and detailed planning of upcoming events, which constitutes the deliverable D4.1 of the H2020-MSCA-Innovative Training Network n° 814215 ENLIGHT'EM.

The purpose of this document is to report the training activities carried out in the project with the main objective of optimizing the training of the early-stage researchers (ESRs) that belong to the training network. Furthermore, a compendium of the results taken from the training events is detailed, as well as a brief description of the next training events and information about their organization.

## **1.2. Document structure**

The remainder of this document includes a description of the training activities in the first year of the project (M1-M12) in Section 2, the results of these training events together with important additional results in Section 3, and finally details of next training events in Section 4.

## 2. Training activities to date

This Section presents the training events that took place since the beginning of the project (M1) to the end of the first year (M12), providing details of the organization and description of the contents.

### 2.1. Training Event 1 (co-located with EWSN 2020)

First, let us indicate what we committed to do based on Annex of Grant Agreement:

*Event 1: Welcome to ESRs and introductory tutorials at conference*

*This event serves as a primer for the ESRs recruited by the network. The event is held at the at the International Conference on Embedded Wireless Systems and Networks (EWSN), a highly reputable venue worldwide. Two tutorials will be offered at the conference on (i) technology and communications aspects of low-energy VLC led by TUD; and (ii) networking and service provision aspects in low-energy VLC led by PHR*

As communicated to the EU, the partner organization Philips (PHR) left the project and Nokia Bell Labs (NOK) entered in its place. Considering this change, the organizers were the beneficiary Delft University of Technology (TUD) and the partner organization Nokia Bell Labs (NOK).

The Training Event 1 took place in Lyon (France) on February 17<sup>th</sup>, 2020. It was co-located within the International Conference on Embedded Wireless Systems and Networks 2020 (EWSN 2020), a highly reputable venue worldwide. A full-day tutorial was offered on the foundation of Visible Light Communication (VLC) for low-power Internet-of-Things devices (IoT), which was composed of two half-day tutorials. The tutorial presented VLC from both an industrial and academic perspective. The talks covered a complete low-energy design for all aspects of VLC. The tutorial was structured as follows:

- First part (during the morning): It had a strong industrial content and covered three main areas: (1) The importance of the visible light spectrum for future communication networks, (2) Current products, prospective applications, and ongoing work in the Research and Development (R&D) labs of some companies, and (3) Standardization efforts.
- Second part (during the afternoon): It had a strong academic content and covered four areas: (1) Hardware Layer: Optical materials used as transmitters and receivers, (2) Physical Layer: Modulation techniques, (3) MAC & Upper Layers plus a demonstration, and (4) Discussion on various research directions using visible light for communication and sensing.

It was open not only to the ESRs in ENLIGHT'EM, but also to the general public that attended the conference. Attendees could choose if they wanted to attend only one or both tutorials. As seen in Figure 1 and Figure 2, the conference room was full, indicating the interest of the community on the topics presented at the workshop. This event provided the opportunity to ESRs to meet with the supervisors of ENLIGHT'EM, with other representative from their organizations, with each ESRs of the projects and other experts in the field.



**Figure 1: Picture of room and one of the speakers during Training Event 1**



**Figure 2: Picture of room during Training Event 1**

The agenda of the tutorial is reported below. In [this link](#) a detailed program of the tutorial as presented in the EWSN 2020 conference website can be seen.

\*\*

## **Industrial Tutorial**

*“Market opportunities and application use-cases”*

### **9.00 Introduction** [Lecturer: Stepan - Nokia]

- Importance of Visible Light Spectrum
- Pros and cons of light propagation in future applications

### **9:10 Integration** [Lecturer: Stepan - Nokia]

- 3GPP networks (4G, 5G)
- IEEE networks (WiFi, WiGig)
- Visible light for IoT
- Energy-efficient communication and backhaul

### **9:50 --- First Break ---**

### **10:00 Applications** [Lecturers: one representative per company]

- PureLiFi
- LightBee
- Toshiba
- Ford
- Discussion [chair: Stepan, Nokia]

*Notes: 15 minutes each company including Q&A*

*Potential structure for each of the presentations from companies*

- *Introduce the company and its vision for VLC*
- *Areas of interest for VLC within the company*
- *Specific VLC products and/or projects*
- *Closing remarks with companies view on VLC*

### **11:00 --- Second Break ---**

### **11:10 Standardization** [Lecturer: Nikola, PureLiFi]

- IEEE 802.15.7 Phy
- IEEE 802.15.7 MAC

- IEEE 802.11.bb
- ITU G.9991

12:00 **End of tutorial**

### **Academic Tutorial**

*“Technical solutions for low-power systems”*

14.00 **Introduction** [Lecturer: Marco, TU Delft]

- A brief history of VLC: from blue LEDs to sensing
- Basics of light propagation for future uses

14.10 **Hardware Layer** [Lecturer: Borja, IMDEA]

- Transmitter: LEDs
  - Basic operation and types of LEDs
  - Properties of LEDs that are relevant for VLC
- Receiver: PDs
  - Basic operation and types of Photodiodes
  - Properties of PDs that are relevant for VLC
- Additional materials for VLC
  - Polarizers, Retroreflectors, Birefringence

14:50 **--- First Break ---**

15:00 **Physical Layer** [Lecturer: Popoola, University of Edinburgh]

- Basic modulation techniques
  - Manchester, PPM, VPPM
- Advanced modulation techniques
  - OFDM (+ variants)

15:40 **Higher layers** [Lecturer: Domenico, IMDEA]

- Medium Access Layer.
- Network & Transport Layers

16:00 --- **Second Break** ---

16:15 **Mobile and Low-Power VLC systems** [Lecturer: Marco, TU Delft]

- LED-to-camera communication
- Screen-to-camera communication
- Visible light backscatter
- Visible light sensing

17:00 **End of Tutorial**

\*\*

All speakers are experts in their respective topics, and all of them are involved in ENLIGHT'EM.

Unfortunately, only a few ESRs could attend the Event 1 since not all of them were on board at that time of Event 1. The ESRs that could attend were the following:

- ESR 1.1: Tilahun Gutema
- ESR 1.4: Talia Xu
- ESR 2.3: Sarmad Mir
- ESR 3.3: James Broadhead

All the content created from this Event has been recorded and it has been uploaded to the [Youtube channel of the project](#). Furthermore, the slides are available to all project partners in the GitLab repository of the project. This way, the ESRs joining later can do the same training remotely at their convenience.



### 3. Results of past events

This section presents the results obtained from the past events, in the form of slides, videos, etc.

#### 3.1. Event 0: Kick-off project meeting

The kick-off meeting of the project allowed all partners to discuss the recruitment strategy and policies, the administrative aspects, the WP coordination, the organization of the next training events, and any other important adjustments. It took place in IMDEA Networks site in June 13-14, 2020. The agenda was the following:

##### **13th of June**

10:00-10:40 Welcome and Project Overview (Domenico Giustiniano, IMDEA)

10:40-11:00 Recruitment strategy (Javier Hervas, IMDEA)

11:00-11:30 Coffee Break

11:30-13:00 WP1-WP3 presentation + presentation of ESR description from Lead Supervisor (WP1-3 leaders, all beneficiaries)

13:00-14:00 Lunch

14:00-14:10 Picture of Consortium



**Figure 3: Picture of ENLIGHT'EM Consortium**

14:10-14:40 Finance (Javier Hervas, IMDEA)

14:40-15:15 WP4 - Training, Secondments (Paolo Casari, IMDEA)

15:15-15:45 Coffee Break

15:45-16:30 WP5 - Dissemination and Outreach (Göksel Çabuk, FORD)

16:30-16:45 Project Deliverables and Milestones (Domenico Giustiniano, IMDEA)

16:45-17:15 Reporting (Javier Hervas, IMDEA)

17:15-17:45 Communication channels among partners (Domenico Giustiniano, IMDEA)

19:30 Social Event

### **14th of June**

9:30-10:00 Lesson learnt from ETN Vision project (Murat Uysal, OZY)

10:00-10:30 Deliverable D6.2 by M2 - Supervisory Board of the network + Advisory Board (Domenico Giustiniano, IMDEA)

10:30-11:00 Coffee Break

11:00-12:30 Deliverable D6.1 by M2 - Consortium Agreement, IPR, Management Budget for IMDEA, and budget for level-2 partners (Domenico Giustiniano, IMDEA)

12:30-13:00 Deliverable D6.7 by M6 - Data management plan (Domenico Giustiniano, IMDEA)

13:00-14:00 Lunch

14:00-16:00 Project plan revisions, questions to PO - if any -, next project meeting and Final Remarks (IMDEA)



**Figure 4: ENLIGHT'EM Consortium during Event 0**

This event was an initial contact for the whole Consortium and laid down the basis for a proper progress of the project. All the materials used and presented during this event has been uploaded to the Gitlab repository of the project. This way it is accessible for any person involved in ENLIGHT'EM.

## 3.2. Training Event 1 (co-located with EWSN 2020)

The material created for the Training Event 1 that can be re-used in the future within the project lifetime, and beyond, are: slides from the tutorial's presenters, videos recorded of the tutorial talks, and some other outcomes for the sake of ESR learning such as networking and knowledge taken from additional talks in the conference EWSN 2020.

### 3.2.1. Slides

The slides created by the speakers of the tutorials are uploaded to the internal GitLab of the project: <https://git2.networks.imdea.org/enlightem/consortium> where only people involved in the project can access them. It can be seen in the following images.

enlightem > Consortium > Repository

The screenshot shows the GitLab repository interface. At the top, there's a breadcrumb trail: 'consortium / Network Events / Event1 / Tutorial'. Below this, there's a section for 'Upload New File' by Domenico Giustiniano, dated 3 weeks ago. A table below lists the repository contents:

Name	Last commit	Last update
..		
Academic Tutorial	Upload New File	3 weeks ago
Industrial Tutorial	Upload New File	3 weeks ago
.gitkeep	Update Network Events/Event0/.gitkeep, Network Events/E...	1 month ago

**Figure 5: GitLab repository of ENLIGHT'EM where the tutorial slides are uploaded**

enlightem > Consortium > Repository

master

consortium / Network Events / Event1 / Tutorial / Industrial Tutorial

History

Find file

Web IDE

Upload New File

Marco Zuniga authored 3 weeks ago

2193a5ff

Name	Last commit	Last update
..		
.gitkeep	Add new directory	3 weeks ago
1_Nokia.pdf	Upload New File	3 weeks ago
2_PureLiFi.pdf	Upload New File	3 weeks ago
3_Toshiba.pdf	Upload New File	3 weeks ago
4_Ford_Otosan.pdf	Upload New File	3 weeks ago
5_LightBee.pdf	Upload New File	3 weeks ago
6_Standarization.pdf	Upload New File	3 weeks ago

Figure 6: GitLab repository of ENLIGHT'EM where the industrial tutorial slides are uploaded

enlightem > Consortium > Repository

master

consortium / Network Events / Event1 / Tutorial / Academic Tutorial

History

Find file

Web IDE

Upload New File

Domenico Giustiniano authored 3 weeks ago

0caf01c0

Name	Last commit	Last update
..		
.gitkeep	Add new directory	1 month ago
1_Introduction.pdf	Upload pdf: Academic Tutorial: Intro	3 weeks ago
2_Hardware_Layer.pdf	Upload New File	3 weeks ago
3_Physical_Layer.pdf	Upload New File	3 weeks ago
4_Upper_Layers_part1.pdf	Upload New File	3 weeks ago
4_Upper_Layers_part2.pdf	Upload New File	3 weeks ago
5_Beyond_Traditional_VLC.pdf	Upload New File	3 weeks ago

Figure 7: GitLab repository of ENLIGHT'EM where the academic tutorial slides are uploaded

Note that slides are private because companies and universities had some reservations about the potential replication of the slides' content without their consent. However, the videos of their talks are fully public.

### 3.2.2. Videos

The tutorial talks were recorded and the videos have been published in the [Youtube ENLIGHT'EM account](#) for the general public. Link to the videos is also provided in the project website: <https://enlightem.eu/dissemination/vlc-tutorial-at-ewsn2020/>. The following figure shows a sample of them:

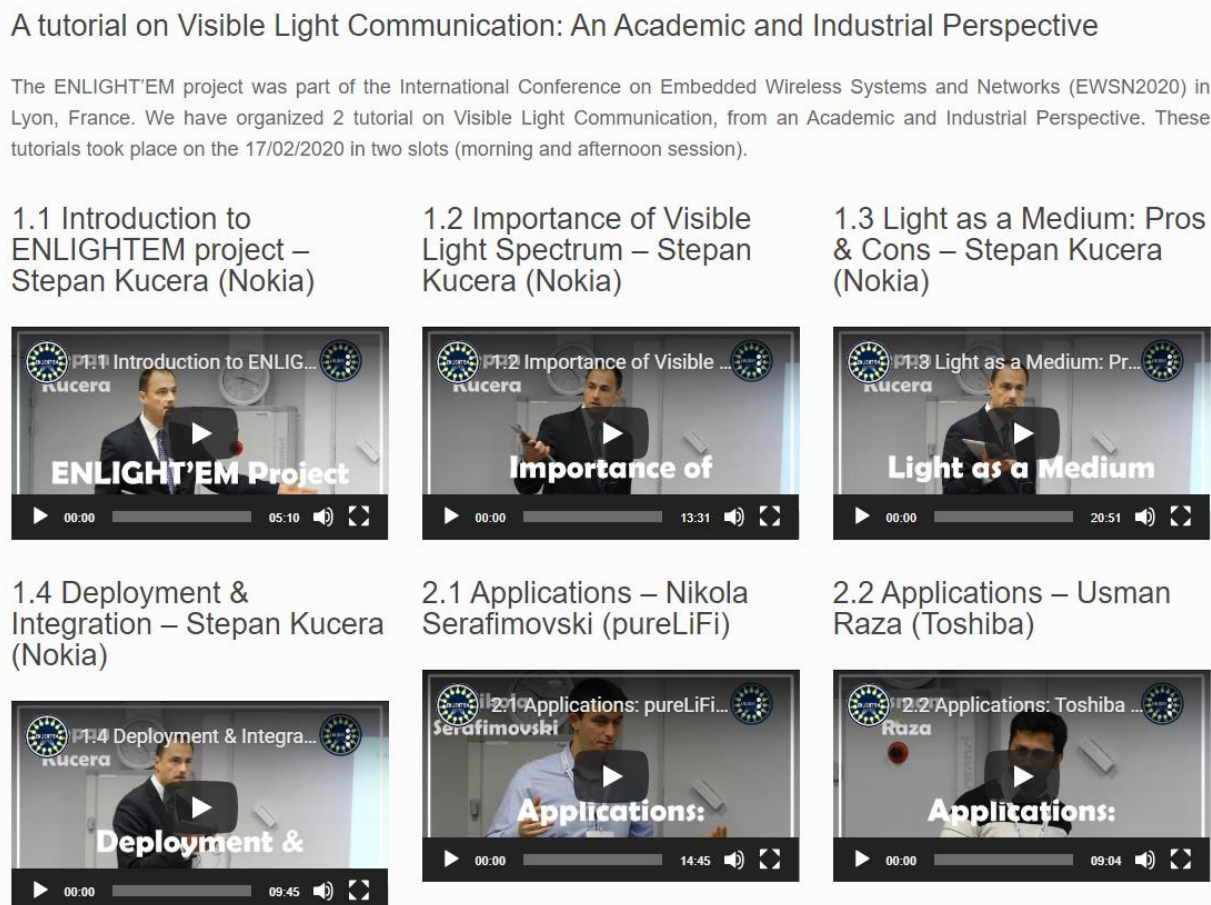


Figure 8: Videos of the tutorials at Event 1

### 3.2.3. Other results

The ESR could attend the whole conference, as they registered to it. Then, to complete their training, they enjoyed 3 full days of cutting-edge research presentations, keynotes and poster session.

On Wednesday February 19<sup>th</sup> the Project meeting #1 took place. It was a meeting in person in Lyon and it was used to discuss the next project deliverables, secondment plan, ongoing activities and potential collaborations. In particular, because of delay in the hiring process, effort was dedicated to optimize the secondment plan such that the ESRs could always find another ESR during the secondment, as written in the Annex 1 of the Grant Agreement. During the



project event, the ESRs have also presented the initial plans for their research, and it has been found that there are collaboration opportunities among some of them. It has been decided that short visits to other project members can be considered during the course of the project, as long as the total duration of the secondments is below that maximum duration set in ITN projects. Several project partners have also shown high interest in the OpenVLC boards, an open source project led by IMDEA for performing research in the fields of the project, and it has been decided that IMDEA will take care of producing boards for project partners as soon as the new version is ready. This can allow to further encourage collaboration among project partners. In addition, the plan for the submission of the deliverables until the next training event has been discussed and agreed.

To summarize the issues addressed, the agenda of the Project meeting #1 was the following:

**WEDNESDAY (19th Feb 2020): Project meeting #1** (both supervisors and ESRs must attend)

9:00AM - 4:00PM (Full day)

Location: Lab Room - Level 0 - Chappe Building

Remotely: For those who cannot attend, they can connect in: Join Zoom Meeting

(we will do our best because unfortunately we will not have an external speaker and microphone)

Agenda of Project Meeting 1:

Issue	Presenter	Time
Tracking reports of ESRs	Borja Genovés (IMDEA)	09:00 – 09:20
Next deliverables: D4.7 (CDPs) with template and dates [Deadline: April 2020]	Borja Genovés (WP4 leader: IMDEA)	09:20-09:30
Plans for secondments supposed to take place in March 2020	ESR 1.1: <b>UEDIN</b> → FORD ESR 2.2: <b>PLF</b> → IMDEA ESR 2.4: <b>UNIPA</b> → ZII ESR 3.1: <b>TREL</b> → SUPSI ESR 3.2: <b>LBEE</b> → UEDIN ESR 3.3: <b>TUD</b> → NOK ESR 3.5: <b>FORD</b> → OZY	09:30-10:30  (5-minutes presentation for each + discussion: ESR or supervisor must do it)
Coffee Break		
Templates, deadlines and way to proceed. (Tools used in the project for deliverables)	Borja Genovés (IMDEA)	11:00-11:15
Next deliverables: D1.1- State of the art review with research progress reports on Low-energy Technologies; approved research proposals. [Deadline: May 2020]	WP1 leader: <b>PLF</b>	11:15-11:25  (brief presentation about the

		planning from WP leader)
Next deliverables: D2.1- State of the art review with research progress reports on Intelligent Algorithms and RF Integration; approved research proposals. [Deadline: May 2020]	WP2 leader: <b>UEDIN</b>	11:25-11:35 (brief presentation about the planning from WP leader)
Next deliverables: D3.1- State of the art review with research progress reports on Applications and Services; approved research proposals. [Deadline: May 2020]	WP3 leader: <b>TUD</b>	11:35-11:45 (brief presentation about the planning from WP leader)
Next deliverables: D4.1- Annual report on training activities, presentation of the results of past events and detailed planning of upcoming events. [Deadline: May 2020]	WP4 leader: <b>IMDEA</b>	11:45-11:55 (brief presentation about the planning from WP leader)
Next deliverables: D5.2- Annual report on dissemination and exploitation results. [Deadline: May 2020]	WP5 leader: <b>FORD</b>	11:55-12:05 (brief presentation about the planning from WP leader)
Next deliverables: D7.1- In case activities undertaken in non-EU countries raise ethics issues... [Deadline: May 2020]	<b>IMDEA</b>	12:05-12:15 (brief presentation about the planning from WP leader)
Lunch Break		
Consolidating all inputs for next deliverables (make a better planning of work given the limited time + some ESRs joined late, external reviewers)	<b>All</b>	13:45-14:00
OpenVLC roadmap and internal distribution	Domenico Giustiniano (IMDEA)	14:00-14:15
MOOC realization (brainstorming): platform, target public, topics... Syllabus by July 2020.	<b>All</b>	14:15-14:45

Status of the NDA of Nokia (all received?)	Stepan Kucera (NOK) will give a feedback and way to get it done	14:45-14:55
Free Discussion	All	14:55-15:45
Coffee Break and end of the project meeting		

### 3.3. Online ENLIGHT'EM meeting for ESRs

Considering that many of our ESRs are working remotely due to COVID-19 pandemic, we saw as a good idea to have monthly ESR meetings in Zoom.

This allows them to form a closer community, gives each other moral support, and establishes sustained collaborations. Some ESRs are working alone from their home countries or in institutions where they are the only PhD.

By the time of writing this report, we can include results coming from the first Zoom call organized for the ESRs in June 26, 2020. Joined ESRs could meet virtually.

The agenda for the meeting was the following:

#### 11:00 to 11:20: Introductions

First, we will get to know each other on a personal level. Enlight'em requires institutions to hire people from abroad and the goal is to create a network. Tell us a bit about yourself and how your transition to a new country has been so far.

#### 11:20 to 12:00: Madness Session

Then, we will get to know each other as researchers. In many conferences, there is a session called 1-minute madness, where you have only one minute to make a pitch for your work. In our meeting, you will have three minutes (show a few slides). Do not worry if you do not have results yet, just tell us about the general direction you want to follow: Why do you want to investigate that specific area? Why is it important to solve those problems? We will be strict with time; a bell will ring exactly at three minutes

#### 12:00 to 12:10: Break

#### 12:10 to 12:30: Open discussion

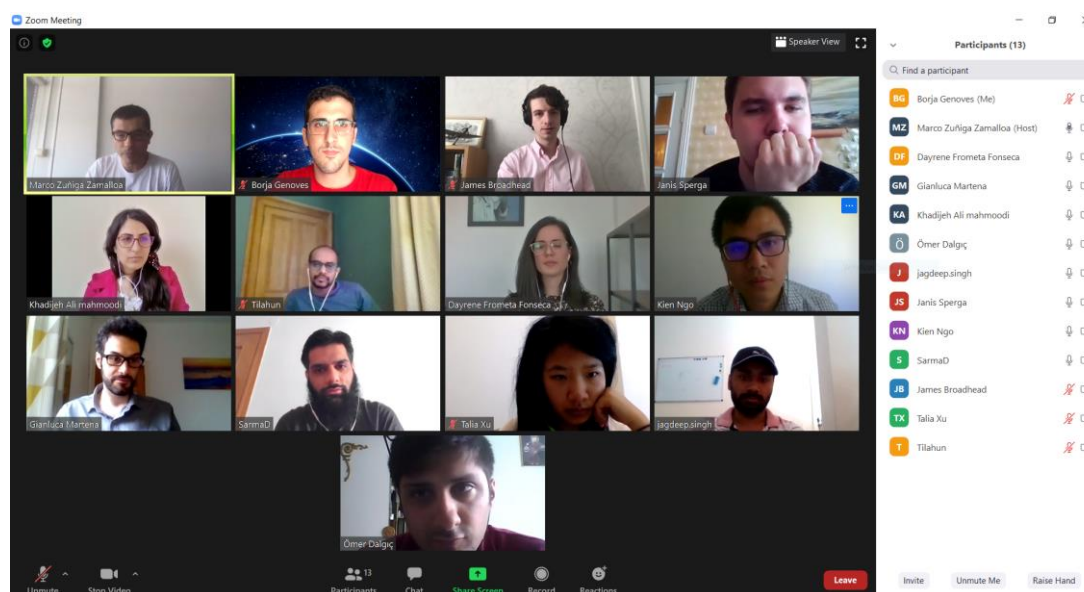
Finally, we will discuss the best ways to enhance our network, in particular, considering the Covid-19 situation. We will be relying on your feedback. Please think about how we can improve your Ph.D. experience, and how you could support each other. We will present your suggestions to the Supervisory Board of the project.



All ESRs that have joined their institutions to date attended the virtual meeting, and it was a great experience as an initial contact for them. These are the ESRs that attended:

- ESR 1.1: Tilahun Zerihun Gutema
- ESR 1.2: Janis Sperga
- ESR 1.3: Khadijeh Aalimahmoodi (female)
- ESR 1.4: Minyin Xu, Talia (female)
- ESR 1.5: Ömer Dalgıç
- ESR 2.2: Giovanni Luca Martena
- ESR 2.3: Muhammad Sarmad Shahab Mir
- ESR 2.4: Ngo Trung Kien
- ESR 2.5: Dayrene Frómeta Fonseca (female)
- ESR 3.1: Jagdeep Singh
- ESR 3.3: James Broadhead

The following figure shows a picture of the meeting while it was taking place:



**Figure 9: Picture of Online ENLIGHT'EM meeting for ESRs**

In addition to the advantages of getting to know each other, we were able to identify potential collaborations among the ESRs as well as additional activities to keep the group joint:

- Khadijeh, Talia, and Sarmad are working with solar panels as receivers. Potential collaborations may appear there.
- Dayrene and Kien are looking into integrating RF and VLC systems. Given PureLiFi's expertise in this area, PureLiFi can provide valuable feedback about the challenges faced in real deployments.
- Khadijeh is planning to work on underwater networks, which is related to the work of LightBee's ESR, there are some pointers below in that general area [1] [2].
- Gianluca, Tilahun and Janis are working on more theoretical problems and they could provide each other feedback.
- There was an interest in having bi-monthly meetings where ESRs can present their work and get feedback. The next meeting will be Event 2 in July and the bi-monthly meetings can be discussed then.

[1] [AmphiLight: Direct Air-Water Communication with Laser Light](#)

[2] [Lasers and LEDs used to provide Internet connectivity underwater](#)

## 4. Planning of upcoming events

This section details the plan for the next upcoming event that will take place from the submission date of this deliverable up to the next annual report D4.2.

### 4.1. Online seminar

A brief online seminar will be organized once all the ESRs have joined their respective institutions. The objective of this seminar is to inform the ESRs about their rights. The details are the following:

- Date: July 2020 or September 2020
- Organizers: IMDEA
- Attendees: ESRs
- Agenda: Information about their rights as ITN research fellows, detailed in [Information note for Marie Skłodowska -Curie Fellows in Innovative Training Networks \(ITN\)](#) provided by the European Commission.

### 4.2. Training Event 2

According to the Annex 1 of the Grant Agreement, the Training Event 2 (*Training on research skills, and project meeting #2*) was expected to take place in Madrid (Spain) in May 2020, namely on the 4-6<sup>th</sup>. It was going to be carried out at the IMDEA Networks Institute and organized by IMDEA and The University of Edinburgh. However, due to the COVID-19 pandemic, the event had to be postponed due to several reasons:

- The hiring of ESRs was disrupted and they were not allowed to join their respective institutions due to governmental restrictions.
- The beneficiaries in the project were affected in the working routine, and their daily research work from home could not be performed as efficiently as in the offices.

Following EU guidelines about the organization of events during the outbreak, we made the decision of postponing the Training Event 2 in order to organize it under more favourable conditions, with the hope that more ESRs could have joined at the time of Event 2. Thus, for efficiency, it has been decided to organize the project meeting of Event 2 on July 13, and the the training of event 2 on July 20-21. This is also to avoid online meetings lasting many days.

The training of event 2 will be focused on research skills required by the ESRs during their PhD programs and careers. The training is divided in two modules:

- Training on Research Organization and Personal Management: the responsible organizer is IMDEA Networks (IMDEA).
- Training on Transversal Research Skills and Impact: the responsible organizer is The University of Edinburgh (UEDIN).

The detailed program is the following:

#### MONDAY (13th July 2020):

- Project meeting #2 (both supervisors and ESRs must attend)

9:30AM - 12:30PM CEST

Location: remotely using Zoom application

**MONDAY (20th July 2020):**

- Training on Research Organization and Personal Management
- Research proposals presentations (ESRs).

9:30AM - 4:30PM CEST (Full day)

Location: remotely using Zoom application

Organizers: IMDEA and UEDIN.

Detailed program:

**Table 1: Detailed content of Training on Research Organization and Personal Management + Research Proposals**

Time	Training module	Talk title	Responsible
9:30-10:30	Research organization & Personal management	Meaning of being a researcher & Tips for and effective use of time (Round table with Distinguished researchers at IMDEA)	IMDEA
10:30-11:00		Thesis roadmap and the contents of an effective thesis	
Coffee break			
11:30-12:00	Research organization & Personal management	How to write papers effectively	IMDEA
12:00-12:30		Emotional intelligence, assertiveness and conflict management	
LUNCH			
14:30-14:40	Research proposal presentations	Enhanced Energy and Spectrum Efficiency in LiFi (UEDIN)	ESR 1.1
14:40-14:50		Low-Power VLC Transmitter Design (PureLiFi)	ESR 1.2
14:50-15:00		Simultaneous Data and Power Transfer (OZU)	ESR 1.3
15:00-15:10		Passive Communication and Sensing (TUD)	ESR 1.4
15:10-15:30	Supervisors discussion	Approval of Research proposals	Supervisors
15:30-15:40	Research proposal presentations	Resource-constrained VLC (SUPSI)	ESR 1.5

15:40-15:50		Resilient LiFi for IoT (UEDIN)	ESR 2.1
15:50-16:00		Algorithms for Joint Reconfiguration of Smart Lighting and LiFi Access Points in Dense Deployments (PureLiFi)	ESR 2.2
16:00-16:10		Integration between home automation and VLC (IMDEA)	ESR 2.3
16:10-16:30	Supervisors discussion	Approval of Research proposals	Supervisors

**TUESDAY (21st July 2020):**

- Training on Transversal Research Skills and Impact.
- Research proposals presentations (ESRs).

9:30AM - 4:20PM CEST (Full day)

Location: online using Zoom application

Organizers: IMDEA and UEDIN.

Detailed program:

**Table 2: Detailed content of Transversal Research Skills and Impact + Research Proposals**

Time	Training module	Talk title	Responsible
9:30 -10:00	Transversal research skills	Effective Literature survey and review	UEDIN
10:05 - 10:35		Managing your research project	
10:40 - 11:00		Overcoming challenges common to doctoral researchers	
Coffee break			
11:30 - 12:00	Impact	Research Communication/dissemination	UEDIN
12:05 - 12:30		Research Commercialisation and Intellectual Property Protection	
LUNCH			
14:30-14:40	Research proposal presentations	Integration of Visible Light and Radio Frequency Communication in the Network Access (UNIPA)	ESR 2.4

14:40-14:50		Integration of VLC Access and mmwave Backhauling (IMDEA)	ESR 2.5
14:50-15:00		VLC-BLE Indoor Positioning System (TREL)	ESR 3.1
15:00-15:10		Power-efficient Underwater Wireless Optical Communications (LBEE)	ESR 3.2
15:10-15:30	Supervisors discussion	Approval of Research proposals	Supervisors
15:30-15:40	Research proposals presentations	VLC-enabled Energy Disaggregation (TUD)	ESR 3.3
15:40-15:50		Optical frontend design for Vehicle-to-Anything (V2X) communication (FORD)	ESR 3.4
15:50-16:00		Low-power Architectures for Reliable VLC in Transportation and Manufacturing (FORD)	ESR 3.5
16:00-16:20	Supervisors discussion	Approval of Research proposals	Supervisors

### 4.3. Training Event 3 (co-located with MobiCom 2020)

As specified in the Annex 1 of the Grant Agreement, the young start-ups in our consortium, LightBee (LBEE) and Velmenni (VEL), will present a training session on entrepreneurship. The focus will be to provide ESRs with the necessary knowledge to create a start-up and understanding the market potential of their work. The topics to be covered are analysis of market competition, spotting of business opportunities and creation of a strong business plan. The event will be held alongside a workshop organized by SUPSI in parallel to the 26<sup>th</sup> ACM Annual International Conference on Mobile Computing and Networking ([ACM MobiCom 2020](#)), a flagship venue covering a wide range of topics including VLC. The conference will be enhanced with a special workshop session dedicated to the topics of the ENLIGHT'EM network. As a result, the ESRs' work will enjoy exposure in front of a top-notch community of experts.

A workshop proposal was submitted to the organizing committee of ACM Mobicom 2020 on February 14<sup>th</sup>, 2020 and it was accepted as a half-day workshop. The details are as follows:

- Date: Monday, September 21<sup>st</sup>, 2020 (Half day - Afternoon)
- Title: Light up the IoT (LIoT 2020) - Research track
- Organizers: Daniele Puccinelli (SUPSI), Julio Rufo (LigthBee)
- Announcement in the conference website:  
<https://sigmobile.org/mobicom/2020/workshops.php>
- Workshop webpage created by us: [https://enlightem.eu/workshops/light\\_up\\_the\\_iot/](https://enlightem.eu/workshops/light_up_the_iot/)

- Keynote speaker: Nikola Serafimovski (PureLiFi)

ACM Mobicom will be held online, and as such, this will be the same for our workshop.

The schedule of the training session on entrepreneurship is currently in preparation. It has been decided that the training session will also be online. As for event 2, we plan to avoid long online sessions for the full event 3, and split the event 3 in two parts, conducted in non-consecutive days.

#### **4.4. Training Event 4**

The organization of this training event is currently under preparation. The information included in the Annex 1 of the Grant Agreement is presented below. We will monitor the Covid-19 situation closely to do our best to have this event in person, else we will perform it remotely as with current events.

- Title: Training on VLC technology & Research commercialisation, and project meeting
- Date: March 2021 (M22)
- Description: The purpose of this event is two-fold and leverages the close-by location of UEDIN and PureLifi (PLF) for improved efficiency. The first half will be led by UEDIN, one of the world's leading centers in VLC research, and has the purpose to train the ESR with the latest advancements in VLC technology, as well as in measurement and experimental technology in general. The second half will be led by PLF, a successful spin off from UEDIN, and will focus on the early-stage development of commercial products based on customer information, and on the technology transfer process from the research into the business world.

## 5. Conclusion

This document presented the training activities during the first year of the project, as well as the results obtained from those past events. Finally, a detailed planning of upcoming events was described.

Training event 0 and 1 took place in the first year, as planned in the Annex 1 of Grant Agreement (GA). Instead Event 2 has been delayed for 2 months with respect to what was planned in the Annex 1 of the GA. The progresses of the project have been affected by the COVID-19 outbreak, and then this deliverable was delayed. However, as presented in this deliverable, measures have been taken to alleviate this situation.