

# [1] Quality of Experience in eXtended Reality Applications

## **Goal**

Study of acceptance, quality of experience, including other socioemotional aspects, such as presence, immersion, empathy in XR experiences designed and developed by the eXtended Reality Lab, Nokia.

Examples of the applications to be tested:

- The Owl: <https://youtu.be/IGrEJGGNdsQ>
- Real Haptics: [https://www.youtube.com/watch?v=E2k\\_5Hk-ONw](https://www.youtube.com/watch?v=E2k_5Hk-ONw)
- Music therapy for elderly people: <https://www.youtube.com/watch?v=ETCdgoHUe38>
- Therapy with horses: <https://youtu.be/DKZYHRnbPmg>

You will work with the eXtended Reality Lab at Nokia evaluating different applications developed and tested in real use cases. You will be involved in the entire process of the user experience assessment: test design, test execution, data analysis, and reporting of results. You will learn test methodologies design and data analysis of results, while being in touch with emerging XR technologies.

## **Conditions**

- 20 hours / week (flexible arrangement and partial remote working)
- Scholarship: 750 €/month
- Minimum duration 6 months (optional extension up to 12 months)
- Expected starting time: September 2023
- Location: Nokia Spain (Las Tablas), María Tubau 9, Madrid

## **Requirements**

- Programming skills for data analysis and statistics (Python or R).
- Basic knowledge of Linux (scripts, command lines...).
- Ability to work with other colleagues and empathize with participants in subjective assessments.
- Proactive, autonomous, and critical thinking.
- Availability to move in work-schedule to different locations inside the Community of Madrid (sporadically).
- Good English level.

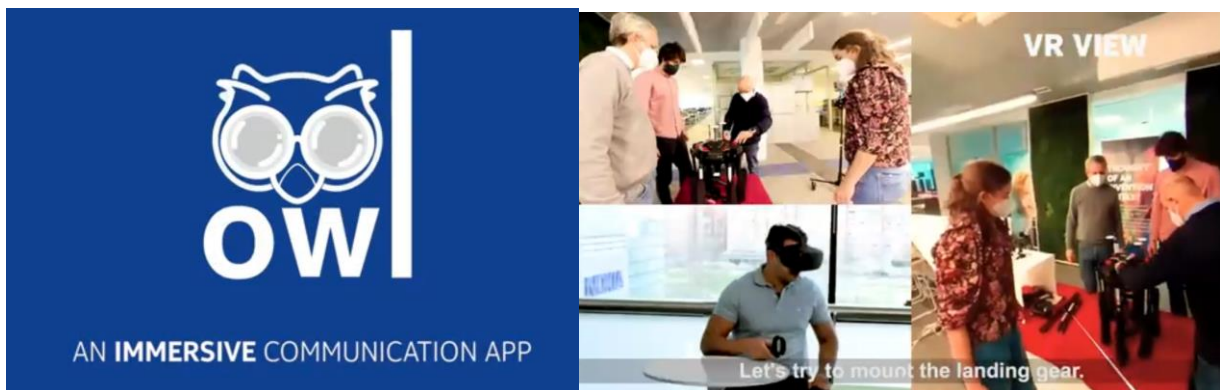
## **Contact**

If you are interested, please send your CV, mark records and motivation letter to: [marta.orduna@nokia.com](mailto:marta.orduna@nokia.com)

## [2] User Interface development for immersive reality platform

### **Goal**

In the eXtended Reality Lab we have developed an immersive telepresence platform to connect users from multiple locations: [The Owl, by eXtended Reality Lab](#)



With this purpose, we have used immersive reality tools, 360 degrees cameras, virtual reality goggles... Now we are adding new functionalities to the platform to **improve the user experience**, because we want that any user with minimal technical knowledge can use it. Therefore, the way in which users interact with devices becomes critical.

In this internship you will work with the research team of the lab in the **design and implementation of a new user interface**, based mainly in a web application visualized in a tactile screen, which will be used to control and manage the whole platform: capture of audiovisual streams from 360 camera and integrated microphones and transmission to remote users, avatar rendering, etc.

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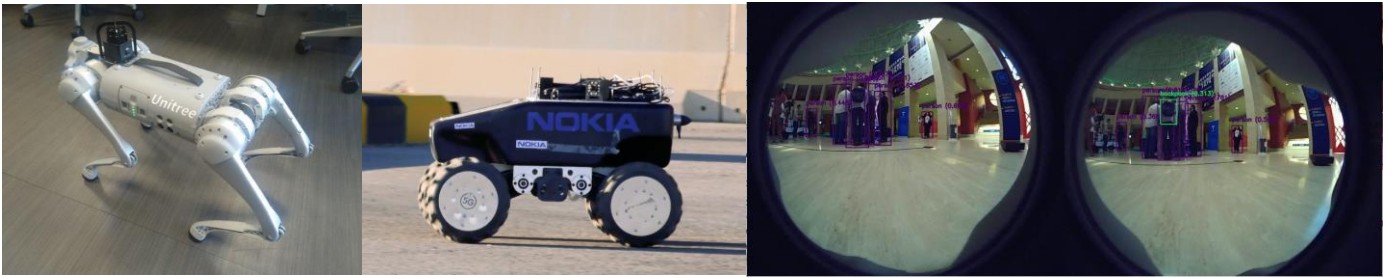
### **Requirements**

- Students finishing their BsC or MsC studies on Computer Science, Electrical Engineering, or similar.
- Front End programming skills (Node, JavaScript, HTML, CSS).
- Usage of Linux systems (scripting, system admin).
- Usage of version control systems (git).
- UX and Docker knowledge will be positively valued.
- Good English level and academic marks.
- Self-management, team work and critical thinking.

### **Contact**

If you are interested, please send your CV, mark records and motivation letter to [juan.torresarjona@nokia.com](mailto:juan.torresarjona@nokia.com)

## [3] Real-time video semantics for robotics and XR applications



### **Goal**

At Nokia eXtended Reality Lab, we have developed an immersive remote driving application that allows us to drive a vehicle (AGV) from anywhere with the feeling of being inside it. In this environment, we want to extend the scope of the application with semantic information from the video captured by the AGV's cameras that may be useful for driving. As can be seen in the image, we have made a first approximation with a state-of-the-art object detection neural network. With this internship we aim to improve the algorithm by:

- Exploring new algorithms from the state-of-the-art that provides a better-quality vs inference time tradeoff.
- Exploring what type of information/events can be useful for remote driving: detection of pedestrians, obstacles...
- Studying how the use of 180° images affects algorithms of the state of the art as well as the possibility of rectifying them for better performance.
- Studying the possibility of creating our own database.

### **Conditions**

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- Expected starting time: September 2023
- Location: Nokia Spain (Las Tablas), María Tubau 9, Madrid

### **Requirements**

- Students finishing their BsC or MsC studies on Computer Science, Electrical Engineering, or similar.
- Machine Learning and Deep Learning knowledge are required.
- Knowledge of computer vision is highly valued.
- Python and knowledge about DL framework: Keras, Tensorflow, Pytorch.
- Good English level and academic marks.
- Self-management, and critical thinking.

### **Contact**

If you are interested, please send your CV, mark records and motivation letter to [nuria.oyaga@nokia.com](mailto:nuria.oyaga@nokia.com) as soon as possible.

## [4] Object Recognition for Extended Reality Applications



### **Goal**

At Nokia eXtended Reality Lab, we have developed a deep learning-based algorithm able to segment human body parts from egocentric videos in real time, as well as some pre-defined objects inspired from state-of-the-art algorithms and making big efforts on data capturing and data engineering. This algorithm is already integrated in several eXtended Reality / Mixed Reality applications, as the one you can see in [this video](#). With this internship we aim to improve the algorithm by:

- Exploring transfer learning techniques to include new objects to be segmented / detected, depending on particular use cases.
- Creating new images, and explore efficient ways to get ground truth labels, such as the use of segment anything tool from META.
- Support the integration of this fined-tuned algorithms into VR applications.

### **Conditions**

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- Scholarship: 750 €/month
- Minimum duration 6 months (optional extension up to 12 months)
- Expected starting time: September 2023
- Location: Nokia Spain (Las Tablas), María Tubau 9, Madrid

### **Requirements**

- Students finishing their BsC or MsC studies on Computer Science, Electrical Engineering, or similar.
- Machine Learning and Deep Learning knowledge are required.
- Python and some knowledge about DL framework: Keras, Tensorflow, Pytorch
- Good English level and academic marks
- Self-management, and critical thinking

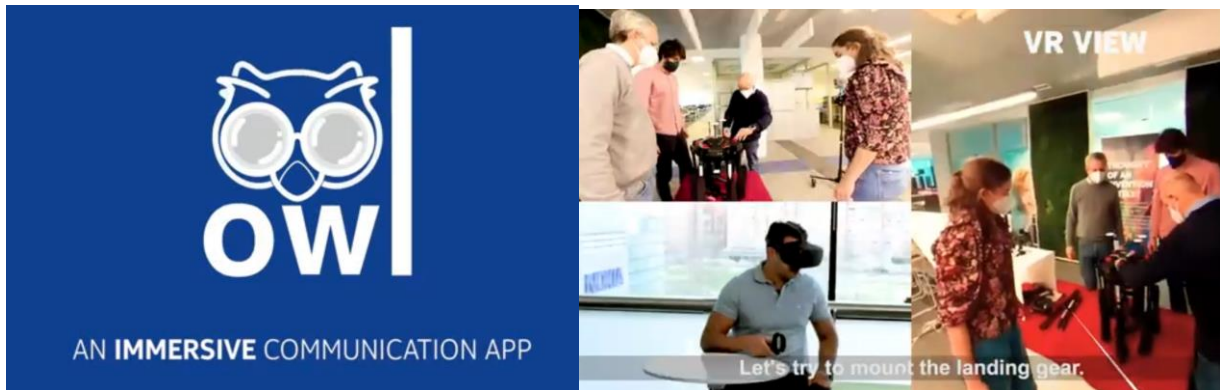
### **Contact**

If you are interested, please send your CV, mark records and motivation letter to [amaya.jimenez@nokia.com](mailto:amaya.jimenez@nokia.com) and [ester.gonzalez@nokia.com](mailto:ester.gonzalez@nokia.com) as soon as possible.

## [5] Computer Vision in immersive applications

### **Goal**

In the eXtended Reality Lab we have developed an immersive telepresence platform to connect users from multiple locations: <https://www.youtube.com/watch?v=lGrEJGGNdsQ>



With this purpose, we have used immersive reality tools, 360 degrees cameras, virtual reality goggles... Now we are adding to the platform new functionalities related to use cases. One of the most relevant is the telepresence in events (meetings, conferences, mentorships, etc.). In this kind of scenarios we want to extract automatically relevant information about what is happening in the surrounding scene. For instance, extract the scene sentiment, whether the event attendees are happy or are getting bored, etc.

<https://viso.ai/deep-learning/visual-emotion-ai-recognition/>

This internship is part of a national R&D project. You will work with the research team in the group on the **design and implementation of computer vision algorithms for analyzing event information from 360 cameras.**

### **Conditions**

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- Scholarship: 750 €/month
- Minimum duration 6 months (optional extension up to 12 months)
- Expected starting time: September 2023
- Location: Nokia Spain (Las Tablas), María Tubau 9, Madrid

### **Requirements**

- Students finishing their BsC or MsC studies on Computer Science, Electrical Engineering, or similar.
- Programming in Python
- Knowledge about Computer Vision and image processing
- Linux systems (scripting, system Admin... =
- Code version control systems (git)
- Knowledge about Dockers will be positively valued
- Good English level and academic marks
- Self-management, team work and critical thinking

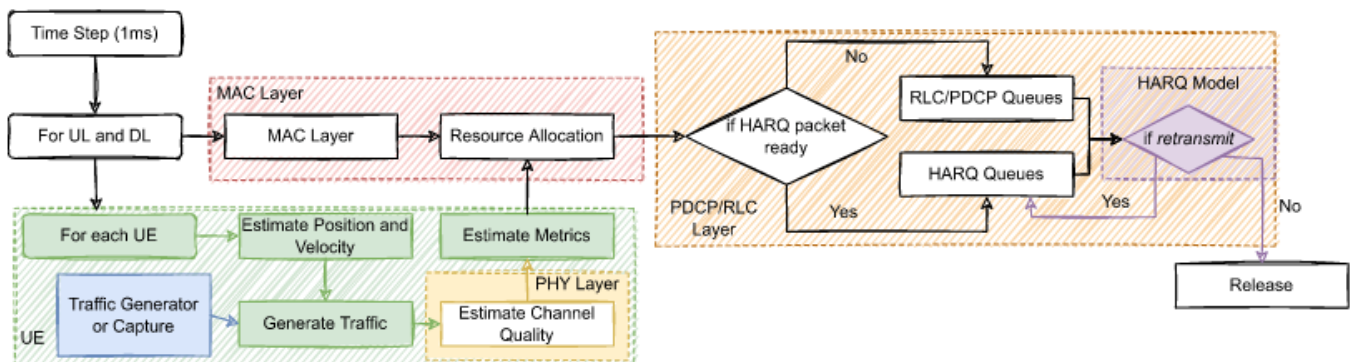
### **Contact**

If you are interested, please send your CV, mark records and motivation letter to

[juan.torresarjona@nokia.com](mailto:juan.torresarjona@nokia.com)



## [6] Design of a virtual 5G gNB for the Metaverse



### Goal

At Nokia eXtended Reality lab, we are creating technology to enable new ways of human communication using Virtual and eXtended Reality (XR) technologies, the basis of the well-known Metaverse. Our goal is to study how 5G and beyond can push the current boundaries of immersive technologies. To understand the impact of the newest generation of wireless networks in the field of XR and, therefore, the future of the Metaverse, we have developed an open-source 5G full-stack emulator: FikoRE (<https://github.com/nokia/5g-network-emulator>). In its current form, FikoRE emulates a generic 5G network from an application-level perspective. However, its modular design allows it to be simply modified to include specific traffic and Quality of Experience (QoE) models to better support XR workloads. In this regard, we plan for this internship:

- Integration of FikoRE on specific hardware to support XR development and to an actual 5G Core. The goal is to have a standalone device which emulates the 5G gNB.
- Design and implementation of algorithms to improve the performance of FikoRE under XR workloads: runtime QoE models for XR services, tailored MAC scheduler, emulation of network slicing...

You will learn the different tools involved in the process, supported by the rest of the team, and then we will define together the focus of your contribution.

### Conditions

- 20 hours / week (flexible arrangement and partial remote working)
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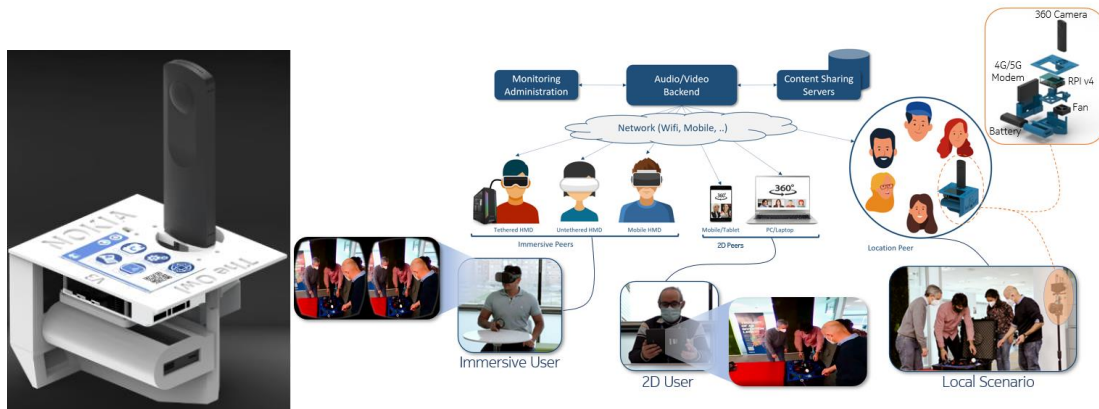
### Requirements

- Students of Telecommunication Engineering or similar (Master)
- Knowledge of mobile and IP networks. Video coding technology is a plus.
- Programming in C/C++. Python is a plus.
- Usage of Linux systems (command line interface, ssh, bash scripting, etc.).
- Initiative, responsibility, autonomy, teamwork.
- Good English level.

### Contact

If you are interested, please send your CV, mark records and motivation letter to: [pablo.perez@nokia.com](mailto:pablo.perez@nokia.com)

## [7] 360 Spatial Audio for Immersive Telepresence Applications



### **Goal**

At Nokia eXtended Reality Lab, we have developed an immersive communication application that uses telepresence to provide an experience much closer to a real meeting with human contact than any existing videoconferencing product. To achieve this goal, we use a combination of immersive audiovisual technologies (mixed reality, 360 video). With this internship we aim to improve the algorithm by:

- Adding 360 spatial audio to the immersive communication application to improve the user experience.
- Studying the microphone setup to capture 360 spatial audio and including it in the current prototype.
- Creating the pipeline to send the 360 spatial audio to the immersive user.
- Creating the application for the immersive user to reproduce the received audio.

### **Conditions**

- 20 hours / week (flexible arrangement and partial remote working)
- Scholarship: 750 €/month
- Minimum duration 6 months (optional extension up to 12 months)
- Expected starting time: September 2023
- Location: Nokia Spain (Las Tablas), María Tubau 9, Madrid

### **Requirements**

- Students at finishing their BsC or MsC studies related to Electrical Engineering, Sound and Image Engineering, or similar.
- Audio technology (sound systems, processing, coding, etc.) knowledge are required.
- Good English level and academic marks.
- Self-management, and critical thinking.

### **Contact**

If you are interested, please send your CV, mark records and motivation letter to [amaya.jimenez@nokia.com](mailto:amaya.jimenez@nokia.com)