



# **PHOTONICS - EUROPHOTONICS MASTER COURSE**

# PROPOSAL FOR A MASTER THESIS

## Dates: February 1<sup>st</sup>, 2023 – September 30<sup>th</sup>, 2023

Laboratory: Centre for Sensors, Instrumentation and systems Development (UPC-CD6) City, Country: Terrassa, Spain

Title of the master thesis:

SOFTWARE AND HARDWARE ARCHITECTURE FOR THE CONSTRUCTION OF A DATA COLLECTION VEHICLE



Name of the tutor of the master thesis: Santiago Royo Email address: santiago.royo@upc.edu Phone number: 34 93 7398904 Mail address: Rambla Sant Nebridi 10 E08222 Terrassa

#### Summary of the subject (maximum 1 page):

#### Which is the problem?

Our research group has in the past developed a large number of lidar prototype systems and technologies for different types of autonomous vehicles, including applications on ground, railway, boats and space vehicles. However, an automotive platform is veru desirable fror getting data in real-use conditions and to gather data and train the datasets which will be required for the future autonomous vehicles.

The project, thus, is oriented to the design of the concept of the car, and to the strat of its contruction. Both the software architecture and the hardware architecture are still to be defined and part of a large-scale research project.

#### What will you do?

You will join our research group, where you'll have support on the use of scanning lidars, power budget models, optical design and modelling, etc. This project aims to conceptualize. And do the first tests, related to the construction of a senorized car for data collection environments linked to autonomous driving.

A thorugh revision of the state of the art, the proposal of different alternatives, and the future contruction of the data collection car will be analysed in the development. Both a software project, including the architecture for the connection of the different sensors, the data gathering, the trining strategy, etc) and the hardware structure (the connections, the placement of the sensors, the data flow architecture, the interfaces) need be considered in detail prior to strat of the integration works.

The interested student will work in a combination of experiment design and modelling tasks, from a very much engineering-oriented point of view, with the goals of

- 1) Achieving a complete design for a decision on feasibility of the construction of an underwater lidar system based on commercial components.
- 2) Benchmarking other available solutions present in science and technology environments, and its main applications
- 3) Analyzing commercially available components, and using their specifications to build a complete detection model for the lidar unit. This in particular involves decisions on the type of laser and the type of detectors to be used, once the ideal waveband has been fixed.
- 4) Setting up one or more subsystems of the lidar (e.g scanning, detector, imaging) charcaterizing them and verifying the results are fine when compared to

This is a combined experimental/modelling Thesis with strong engineering flavours which can be oriented towards the software or hardware side depending on the interest and skills of the student. Basic programming skills (fluent Matlab or Python) and basic knowledge of electronics and optical system design are desirable, but not strictly required.

Keywords: integration, metrology, autonomous vehicles, ROS, Python, deep learning, datasets

### Additional information :

\* Amount of the monthly allowance (if it is the case): To be discussed depending on the value of candidate.

\* Required skills:

Interest in application-driven experimental work for solving real-world problems. Basic concepts in optical metrology and optical engineering

Programming (C++ desirable, Python or proficiency in Matlab minimum) and use of scientific software packages (Labview...)

Search of resources, both scientific and technical

Self-motivated, objective-driven, capable of autonomous working within a multidisciplinary team.

\* Miscellaneous:

This thesis contents will be considered <u>confidential</u> due to its closeness to market.

International team with several years of experience in the topic proposed.

Multidisciplinary environment with electronics and mechanics workshops, and specialists and technicians in metrology, optics, mechatronics, and electronics.

Possibility of joining the Centre for a PhD/Project Manager career in case of common interest. Early incorporation welcome.