# PHOTONICS - EUROPHOTONICS MASTER COURSE

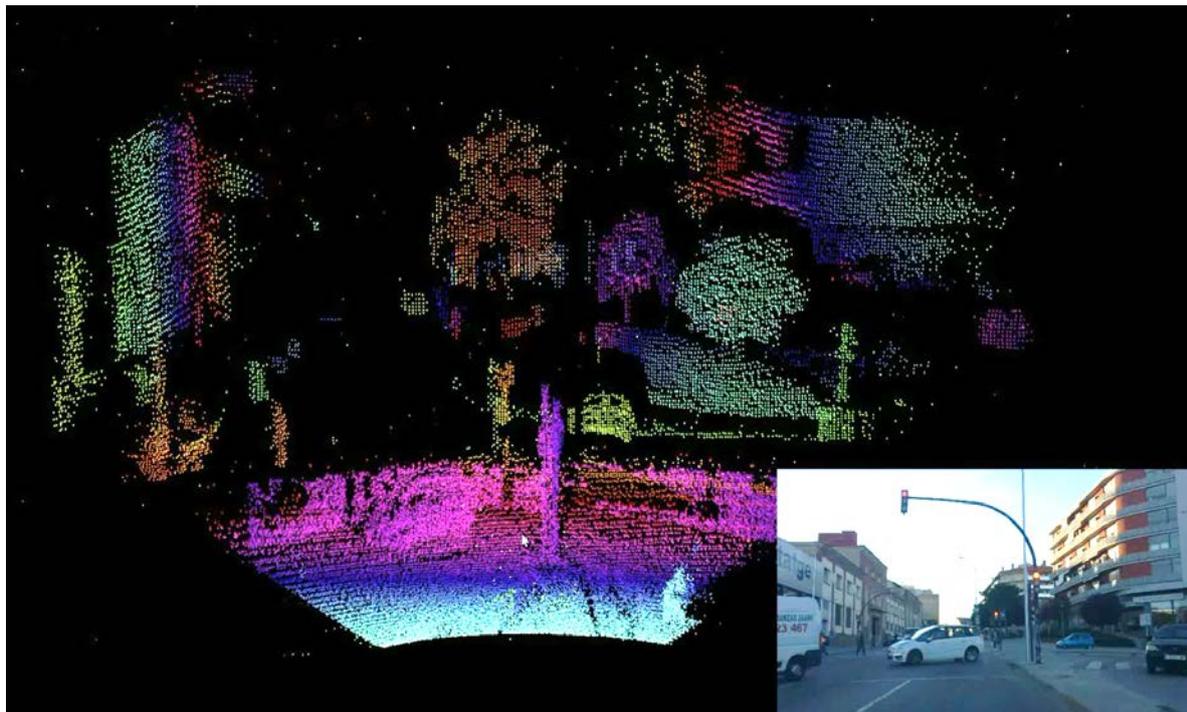## PROPOSAL FOR A MASTER THESIS

**Dates : April 1st, 2019 – September 31st, 2019**

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

**Title of the master thesis :**

## Generation of basic SLAM maps from dense LIDAR images

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

Lidar imaging is a powerful measurement technique where a laser pulse is shone onto an object and the beam reflected back is recovered at some solid-state detector. The time elapsed is counted so an automated measurement of the distance to the target is obtained, without any further calculation. The concept is also referred to as ladar or time of-flight imaging. Most popular recent applications involve landing aids, object recognition, self-guided vehicles and safety and security applications in transport.

Currently, there is already a strong debate on whether the final solutions for autonomous vehicles will be based on complementing already existing maps (i.e Google or the like), or if the maps will be generated themselves by the cars in some collaborative manner. Anyway, the capability of building maps out of lidar-based images by processing the obtained raw point cloud will be needed in both situations. Simultaneous localization and mapping (SLAM) is the computational problem of constructing or updating a map of an unknown environment while simultaneously keeping track of an autonomous agent's location within it. Applications in advanced driver assistance systems (ADAS) or autonomous vehicles, are more interested in the reconstruction of the environment for analysis purposes than in the localization, which is already provided by other systems such as GPS and urban or road maps.

Beamagine is a spin-off company of UPC which develops lidar cameras based on propietary technology and currently has projects in three different markets related to data fusion. See http://beamagine.com  for a glimpse on the potential of the company and of lidar imaging.

The student in charge of this project will implement SLAM strategies based on lidar imaging. This involves studying available alternatives such as Kintinuous or Elastic Fusion for 3D reconstruction from pointclouds, and the implementation and optimization of a selected alternative in order to validate the results and evaluate its performance.

**Keywords :** lidar cameras**,** SLAM, mapping, time-of-flight, 3D imaging, point-cloud processing

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**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++, MatLab) and use of scientific software packages (Zemax, 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.
<u>Early incorporation welcome</u>.