ID38 - LITTERDRONE: MARINE LITTER CHARACTERIZATION USING DRONES AND IMAGE ANALYSIS

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Abstract
This communication is about "LitterDrone" project. LitterDrone is funded via the Blue-Labs program of the European commission and it aims to make a contribution to solve the problem of marine litter. Part of this problem is monitoring stranded marine litter on beaches (measuring number and type of litter elements). Monitoring results can be used to infer data on litter origin and on the influence of tides, currents and human activity. OSPAR convention [1] is a joint European initiative that tries to unify forces against marine pollution. Part of this convention implies that contracting parties (countries) must monitor periodically stranded marine litter on beaches. Spain has signed the convention in January 1994. Litter monitoring in Spain is nowadays implemented by human personnel counting (& picking) litter items in certain beaches at certain times (4 campaigns each year, one for each season). LitterDrone project aims to create a new and/or complementary methodology based on obtaining images from drone flights (creating orthomosaics of RGB and multiespectral images) and developing software to analyze such images to obtain results comparable to those of the manual sampling.

Keywords – marine litter, coastline, beach, drone, camera, remote sensing, computer vision.

I. THE PROJECT
LitterDrone project is being developed by a consortium constituted by the University of Vigo, project leader, the company Grafinta S.A. and the Spanish Association of Marine Litter (AEBAM). The project has the support of ECOEMBES and the collaboration of "Parque Nacional Marítimo-Terrestre de las Islas Atlánticas de Galicia" (PNIAG).

II. FLIGHTS & IMAGE ACQUISITION
Images are obtained with a UAV/RPA platform using auto-pilot over the section of interest. Different platformcamera combinations have been tried, being the most useful:
- Platform: multirotor at 10-20 m high. Above this height resolution becomes less than 1 cm per pixel and detection of small-sized debris is not possible. Fixed wing platforms were tested with less success because they must fly higher (can be useful to detect large debris in long stretches).
- RGB camera (conventional, visible light, camera).
- Multispectral camera: we used MicaSense, RedEdge model. It has 5 bands: R, G, B, NIR (near infrared) and RE (RedEdge: border between red and infrared).
The UAV platform will shoot images periodically (one image every t0 seconds), so that we will get plenty of images per flight. A photogrammetry application is used to integrate all of them in a single global image (ortho-mosaic). Commercial software Photomodeler [3] has been used, although there exist other options, including open-source.

II. IMAGE PROCESSING
Ortho-photos are then processed with a CV (computer vision) application. CV is mainly used because of the lack of most discriminant hyperspectral information [2] due to the reduced cost of the cameras we are using. Processing is done in two stages: first detection, then recognition of most common objects. A human operator must revise classification results.

IV. CONCLUSIONS
LitterDrone is a project that tries to improve the processes of monitoring and control of marine litter on European beaches. It is designed after the principles of the OSPAR protocol [1], which is followed by the EU countries, including Spain. The project consists of the development of new methodologies based on the capture of aerial images through unmanned platforms (drones) and different types of cameras.
Capture is made using state of the art technology based on standard cameras and photogrammetry software.
Analysis of the images is done through image processing software developed in MATLAB environment.
Methods are based on artificial vision techniques. However, the results are useful and original since there is no other software capable of a similar process.
LitterDrone is a two-year project that ends on January 31, 2019.
Main future lines are the following:
- Testing with other types of sensors, such as hyper-spectral and thermal cameras (thermal cameras tests are ongoing just now), searching for new discrimination possibilities.
- Improving image recognition, adding new patterns to the current system and/or testing other methods. The use of more advanced techniques such as convolutional neural networks is not discarded, although, currently, the existing database is not enough for this type of training.

V. ACKNOWLEDGEMENTS
The authors would like to thank the funding received from the European Commission through the action "EASME / EMFF / 2016 / 1.2.1.4". In addition, we appreciate the financial collaboration of Ecoembes and the help provided by the "Parque Nacional de las Islas Atlánticas de Galicia".

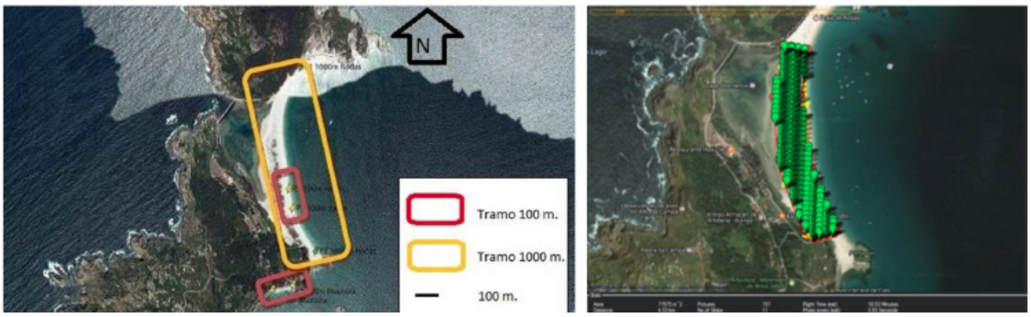

Fig 1. Left: interest areas in Rodas beach (coincide with the two sections of the official study: 100 & 1000 m). In "Nosa Señora" beach, we define another 100 m transect. Right: graphic report of a real flight where all the shooting points are represented

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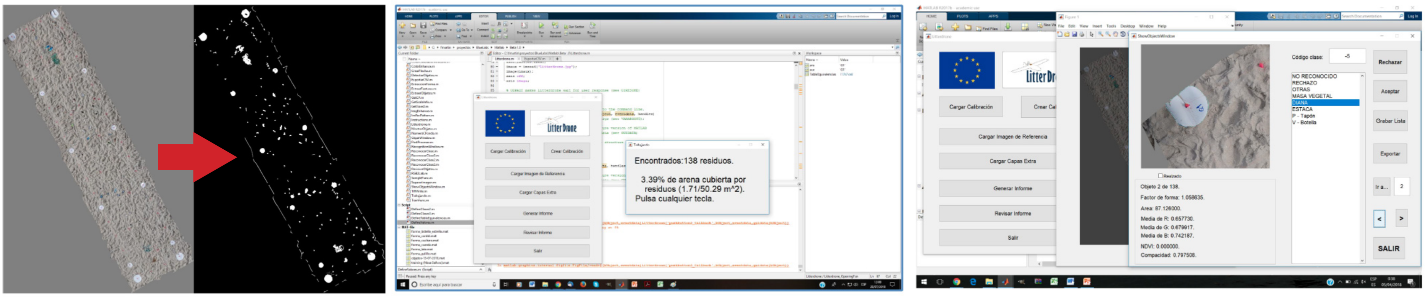

Fig 2. Left: debris location. Center: global automatic report. Right: recognition revision.