

# Francesco Crocetti

## *Curriculum Vitae*

### Education

- January, 2019 **Licence to practice as an Engineer**, *The University of Perugia*, Perugia, Italy.
- 14 September, 2018 **Masters Degree in Information and Automation Engineering**, *The University of Perugia*, Department Engineering (DI), Perugia, Italy..
- 8 May, 2015 **Bachelor Degree in Information and Electronic Engineering**, *The University of Perugia*, Department of Engineering (DI), Perugia, Italy.

### Masters Thesis

- Title *Design of Mobile Robotic System for Indoor Environments and Implementation of Convolutional Neural Network-Based Localization Algorithms.*
- Supervisors Professor Paolo Valigi & Dott. Gabriele Costante Ph.D.
- Description In this work, we converted a '90s robotic platform Pioneer P3-DX at software and hardware level, to make it compatible with the new technological standards in terms of connectivity, computational and sensor capabilities. The purpose was to verify whether robust algorithms designed for outdoor automotive applications can achieve the same performance in indoor industrial scenarios. In particular, we focussed on the navigation of the robot and equipped it with the State-of-the-Art Flownet ST-VO, a CNN-based artificial vision algorithm for Visual Odometry. Experimental results demonstrated the suitability of the setup.

### Bachelor Thesis

- Title *Development and Test of a Quadrotor Drone in V-Tail configuration*
- Supervisors Professor Paolo Valigi & Doctor Thomas Ciarfuglia, Ph.D.
- Description In this work we present a systematic study of an alternative quadrotor configuration know as V-tail. Through both mathematical and field experiments we show that this configuration is able to achieve better performance in manoeuvring control, while losing some power only in the stationary hovering task. In addition, these increases in performance are obtained with the same attitude control of the standard quad-rotor, making this configuration very easy to setup.

## Experience

### Research

November, 2019 – Present  
**Ph.D. Student**, UNIVERSITY OF PERUGIA, DEPARTMENT OF ENGINEERING, Perugia, Italy.

April, 2020 – May, 2021  
**Miur - Assegno Ricerca**, "*Perception, localization, navigation and control techniques for mobile robots with application to precision farming*", UNIVERSITY OF PERUGIA (ITALY), DEPARTMENT OF ENGINEERING, CUN Area: 09 - Industrial and information engineering, S.S.D : ING-INF/04.

*Activity details:*

- Robot System - Design, selection, and integration of the ATV-Robot's electronics systems: brushless motor, motor inverters, Onboard-PCs, networking, control unit, and CAN interface.
- Robot modeling - Kinematics, dynamics and control simulations.
- Perception - State Of The Art study of SLAM algorithms and techniques for outdoor scenarios.
- Integration - Algorithm implementation using the Robot Operative System (ROS).

April, 2019 – April, 2020  
**Miur - Assegno Ricerca**, "*Study and development algorithms for parameter estimation and prognostic tools, with application to the aeronautic field*", UNIVERSITY OF PERUGIA (ITALY), DEPARTMENT OF ENGINEERING, CUN Area: 09 - Industrial and information engineering, S.S.D : ING-INF/04.

*Activity details:*

- Problem analysis - Study of the state of the art focused on the identification of the most suitable approaches.
- System modelling - Design and simulation of dynamic systems based on Simulink.
- Machine Learning Algorithms - Implementation of a set of possible neural networks suitable to the problem.
- Integration

January, 2019 – April 2019  
**Miur - Assegno Ricerca**, "*Study and development of data-oriented algorithms for models aimed at anomaly detection and prediction*", UNIVERSITY OF PERUGIA (ITALY), DEPARTMENT OF ENGINEERING, CUN Area: 09 - Industrial and information engineering, S.S.D : ING-INF/04.

*Activity details:*

- Study of the state of the art focused on the identification of the most suitable approaches.
- Exploratory Data Analysis.
- Implementation of the first set of the possible algorithms and their evaluation.

- December, **Laboratory Activity**, UNIVERSITY OF PERUGIA, DEPARTMENT OF ENGINEERING, Perugia, Italy.  
2017 – March 2018 Refactoring of a PIONEER PX3-DX terrestrial robot in the context of Industry 4.0  
*Detailed achievements:*
- Selection of the HW devices suitable for the project.
  - SW and HW Integration of a Nvidia Jetson TX1 embedded computer module with the P3DX original controller.
  - 3D design of custom structural elements.
  - Design and realization of an additional power supply PCB.
  - C++ Bluefox RGB camera driver implementation for ROS Middleware.
  - Integration of the additional peripherals (laser 2D Scanner, USB HUB, Bumpers).
  - Software implementation of a dedicated WLAN access point with 'Hostapd' daemon tool.
- December, **Laboratory Activity**, UNIVERSITY OF PERUGIA, DEPARTMENT OF ENGINEERING & FRANCESCO MORLACCHI MUSIC CONSERVATORY, Perugia, Italy.  
2016 – April 2017 Hardware design and programming of a musical gamepad, to interactive electronic music production.  
*Detailed achievements:*
- Selection of the HW devices suitable for the project.
  - Development of the C++ code for ATMEGA328 processors family.
- December, **Laboratory Activity**, UNIVERSITY OF PERUGIA, DEPARTMENT OF ENGINEERING, Perugia, Italy.  
2015 – March 2016 Realization of a custom hexacopter for experimental research purposes.  
*Detailed achievements:*
- Selection of the HW devices suitable for the project.
  - SW and HW Integration of a Nvidia Jetson TK1 embedded computer module with a Pixhawk flight controller.
  - 3D design of custom hexacopter parts.
- November, **Laboratory Activity**, UNIVERSITY OF PERUGIA, DEPARTMENT OF ENGINEERING, Perugia, Italy.  
2015 – February 2016 Realization of a PLC-based setup for traffic lights control.  
*Detailed achievements:*
- Omron Cx-One suite programs
  - Sequential Function Chart programming.
  - Ladder programming.
- January, **Research Internship**, UNIVERSITY OF PERUGIA, DEPARTMENT OF ENGINEERING, Perugia, Italy.  
2015 – June 2015 Development and test of embedded systems for electronic braking of a 2.0 Kw/h wind turbine.  
*Detailed achievements:*
- Analysis of State-of-the-art approaches for electric braking techniques.
  - Development of braking system on embedded board, based on PID implementation on ATMEGA328 processors family.
  - Development of a PCB power interface.
  - Test and optimization of the PCB for the integration with pre-existent systems.

May, 2014 – **Research Internship**, UNIVERSITY OF PERUGIA, DEPARTMENT OF ENGINEERING & PROMOVVIDEO S.R.L., Perugia, Italy.

September, 2014 Research and cooperation with Promovideo S.R.L. to study and develop embedded wireless tally light module

*Detailed achievements:*

- Development of master interface board for video mixer PANASONIC AV-HS450U1E.
- Development of radio modules, Xbee 2.4 Ghz based.
- Implementation and analysis of software and libraries for master interface.
- Final product: 4 transceiver modules, 1 Master interface board

December, 2013 – **Research Internship**, UNIVERSITY OF PERUGIA, DEPARTMENT OF ENGINEERING, Perugia, Italy.

February, 2014 Modelling and construction of a quadcopter with V-tail configuration. Analysis of performance compared to the classical X Configuration. Research activities and studies on Machine Learning and Computer Vision approaches for Robotics applications.

*Detailed achievements:*

- Analysis of V-tail quadrotor dynamics.
- Sizing propellers, engines and ESC.
- Construction of the V-tail drone prototype.
- Firmware update of the microcontroller implementing the navigation system.
- Matlab simulation and construction the test rig for the validation of the theoretical results.

### Professional

September, 2018 – **Project Development**, WEEDEA S.R.L., Perugia, Italy.

Present Desing of the functional blocks of the Proof of Concept of the Secure Shelter System and to monitor temperature and position in real time.

*Detailed achievements:*

- Design of electrical and electronical components.
- Design of a second order analog LPF for the ADC acquisition system.
- 3D design of dedicated mechanical components.
- Design of the FIR filters for online acquisition.

July, 2015 – **Project Development**, ICT4LIFE S.R.L. & DEPARTMENT OF EXPERIMENTAL MEDICINE, SECTION OF HYGIENE AND PUBLIC HEALTH , Perugia, Italy.

August, 2017 Refactoring of ICT infrastructure of the Department of Experimental Medicine aimed at ensuring the C.I.A. requirements.

*Detailed achievements:*

- Design of internal network topology.
- Configuration of L3-switches.
- Setup of DHCP and RADIUS Servers.
- Firewall rules design and set.
- Server HW maintenance.

October, 2014 – **Project Development**, HOME SECURITY, EMBEDDED SOLUTION, Perugia, Italy.

Design and development of laser perimeter, for intrusion detection in large surfaces.

March, 2015 *Detailed achievements:*

- Construction of laser turrets equipped with 4 infrared lasers and 4 detection photodiodes.
- Software for upload and analysis of detections.
- Mobile app development for human interface.
- Hardware development for minimize the detection errors.

## Publications

### Journals

- 2016 **Modelling and simulation of a quadrotor in V-tail configuration**, *Enrico Bellocchio, Thomas A. Ciarfuglia, Francesco Crocetti, Antonio Ficola, Paolo Valigi*, International Journal of Modelling, Identification and Control.
- 2020 **Data-Based Design of Robust Fault Isolation Residuals Using LASSO Optimization**, *Silvia Cascianelli, F. Crocetti, G. Costante, P. Valigi, M. L. Fravolini*, Asian Journal of Control - ISSN 1561-8625 , pp. 1-15.

### Conferences

- 2014 **An Experimental Analysis of V-Tail Quad-Rotor Dynamics**, *Thomas A. Ciarfuglia, Francesco Crocetti, Antonio Ficola, Paolo Valigi*, International Conference on Modelling, Identification and Control (ICMIC), Melbourne, Australia.
- 2019 **Data-Based Design of Robust Fault Isolation Residuals Using LASSO Optimization**, *Silvia Cascianelli, Francesco Crocetti, Gabriele Costante, Paolo Valigi, Mario Luca Fravolini*, international Conference on Control, Automation and Diagnosis (ICCAD), Grenoble, France.
- 2020 **PCA Methods and Evidence Based Filtering for Robust Aircraft Sensor Fault Diagnosis**, *N. Cartocci, G. Costante, M.R. Napolitano, P. Valigi, F. Crocetti, M.L. Fravolini*, Mediterranean Conference on Control and Automation (MED), Saint-Raphaël, France.
- 2020 **A Data-Driven Slip Estimation Approach for Effective Braking Control under Varying Road Conditions**, *F. Crocetti, G. Costante, M.L. Fravolini, P. Valigi*, Mediterranean Conference on Control and Automation (MED), Saint-Raphaël, France.

## Computer skills

Basic AutoCAD, Solidworks

Intermediate TENSORFLOW, JAVA, MYSQL, C

Advanced PYTORCH, KERAS, MATLAB, PYTHON, L<sup>A</sup>T<sub>E</sub>X, Linux, Microsoft Windows, Altium Designer, PSpice, Hardware Design, System Integration, Robot Operating System (ROS), C++, Ladder

## Languages

Italian Mother-tongue

English Upper Intermediate

French Basic