

PERSONAL INFORMATION

Michela Longhi

WORK EXPERIENCE

Microwave Vision Group (MVG)

(31 January 2021 - now)

RF and System Engineering at MVG

Microwave Vision Group – Research Antenna Division

Via dei Castelli Romani 59, 00040 Pomezia RM<https://www.mvg-world.com/en>

System engineer in different projects for designing and testing of high performance antennas. I usually work towards goals and know how to communicate with an international team of worldwide specialists and manage and supervise young engineers.

Microwave Vision Group (MVG)

(1 September 2019 - 30 January 2021)

R&D Engineering in the Antenna Division of MVG

Microwave Vision Group – Research Antenna Division

Via dei Castelli Romani 59, 00040 Pomezia RM<https://www.mvg-world.com/en>

I was the RF Engineer in the Antenna Group at MVG company, projecting, realizing and testing many different EMC technologies from 5G to automotive. I was involved in telecommunications, aerospace, automotive, consumer electronic and EMC research projects

**Informatics Domotics
Environment Automation
(IDEA)**

(12 April 2019 - 31 August 2019)

R&D Engineering of IDEA

Informatics Domotics Environment Automation - IDEA

Via Luigi Albertini 36, 60131 Ancona AN<https://www.idea-on-line.it/>

As R&D Engineer in IDEA, I was involved in the development of these topics: fault diagnosis, IoT, Machine Learning and wireless technology. I have also managed information between international groups for European projects.

Doctor of Philosophy (PhD)

(1 November 2015 - 11 April 2019)

PhD European Label at “Università degli Studi di Roma Tor Vergata”

University of Rome “Tor Vergata”

Department of Civil Engineering and Computer Science

Pervasive Electromagnetics Lab

University of Rome “Tor Vergata”, Via del Politecnico 1, 00133 Rome, Italy<http://www.pervasive.ing.uniroma2.it>**RESEARCH GROUP: Pervasive Electromagnetic Lab**

During the PhD period, I have designed and prototyped RF devices for short-range sensing on Drone devices, to be embedded into objects, plants, buildings with application to Smart City, Precise Agriculture and Supply Chains. I have participated at many conferences, as cheer and presenter. Moreover, I token lessons to university students. I also had been a tutor in Erasmus mobility for student of the Tor Vergata University.

**International Doctor of Philosophy
(PhD)**

(1 November 2017 - 31 May 2018)

International PhD at “Eidgenössische Technische Hochschule Zürich”**ETH Zurich**

ETH-Zurich – Autonomous System Lab (ASL)

Eidgenössische Technische Hochschule Zürich, Rämistrasse 101, 8092 Zürich, Switzerland

Department of Mechanical and Processing Engineering

Institute of Robotics and Intelligent System

<http://www.asl.ethz.ch/>

RESEARCH GROUP: Autonomous System Lab

I had worked in the Robot Lab, researching about intelligent robots and systems which operate autonomously in complex and variable environments. I improved team building and problem-solving skills, becoming autonomous in managing many innovative projects and working as tutor for many students.

Research Fellow at CNR

(1 April 2015- 31 October 2015)

Research Fellow at Consiglio Nazionale delle Ricerche (CNR)

Consiglio Nazionale delle Ricerche CNR - Istituto di Elettronica e Ingegneria
dell'Informazione e delle Telecomunicazioni IEIIT

Politecnico di Milano, P.zza Leonardo da Vinci, 32, Milan, Italy

<http://www.ieiit.cnr.it>

RESEARCH GROUP: Engineering for Health and Wellbeing

The research activity has been focused on “Electromagnetic Fields (EMF) and Health”. The objective of this activity has been the study of the neuromodulation and neurostimulation based on electromagnetic principles; in particular, it has been focused on the transcranial magnetic stimulation of deep brain regions (DBS).

**Physics Dept at UNIVPM and
Experiment at the ESRF**

(7 January 2015 - 28 February
2015)

Experiment at the European Synchrotron Radiation Facility (ESRF)

European Synchrotron Radiation Facility, ESRF - The European Synchrotron
CS 40220, 38043 Grenoble, France

Experiments activities in the laboratories of European Synchrotron for probing biaxial order in the nematic phase of bent-core liquid crystals. Plan and organize were the focus point in this experience, to identify objectives and priorities and consider the time available.

Trainee period at ESA

(1 April 2014 - 31 August 2014)

Trainee Period at European Space Agency (ESA)

European Space Agency, ESA – ESTEC
*Kepleraan 1, 2201 AZ
Noordwijk, The Netherlands
<http://www.esa.int>*

My first international working experience was at ESA. In this prestigious organization, I tested my knowledges and realized phototypes of my ideas. In particular, I have designed passive satellite components as directional bimodal coupler for a compact beam-forming network. I worked in a competitive and challenging team, growing my self-confidence in an international context.

University Internship

(2 April 2014 - 31 September
2014)

Department of Information Engineering, “Università Politecnica delle Marche”

Università Politecnica delle Marche
*Via brecce Bianche 1, Ancona, Italy
<http://www.univpm.it>*

Analysis and design of electromagnetic systems for aid to walking for visually impaired athletes. I have been involved in an international project with the Universidad Politecnica de Valencia to create electromagnetic prototypes for helping athletes with difficulties.

Date	11 April 2019
Title of qualification	PhD European label in “Computer Science, Control and Geoinformation”
Name and type of organization	University of Rome “Tor Vergata”
Thesis title	“Hybrid RFID-UAV Frameworks for Ubiquitous Identification, Sensing and Mapping”
Thesis abstract	<p>Today, the idea to create interconnection among multiple devices for sharing information, is crucial. The Internet of Things (IoT) paradigm allows connections for acquiring information. Connections are made to improve the life quality and perception. Humans create even more infrastructures to reach this purpose, but they are not the only one. Many more humanoids and autonomous robots start to populate the everyday life. One of the more fascinating type is the Unmanned Aerial Vehicles (UAV), able to cross the sky as well as fly in small indoor spaces. The practical implementation of many technologies to develop the IoT more pervasive as possible, crush to the cost problem. The Radio Frequency Identification Technology (RFID) efficiency answer to this problem. It is a low-cost miniaturizable technology able to be adaptable in many situations such as harsh environments, building, humans’ skin, clothes and many more. If UAVs and RFIDs technologies are merged together, a set of completely new opportunities and application fields are created. The Thesis addresses this interesting new idea by the developments of three different parts. The first one (Part I), is an introduction to the RFID and UAV worlds, together with the possible scenarios of application for the innovative hybrid solution. Then, the Thesis is parted in two innovative systems: The Reader-Drone (Part II) and the Tag-Copter (Part III). For each architecture, the electromagnetic models are developed to identify the upper-bound communication performance and some open-air empirical tests were performed to corroborate the theoretical analyses.</p>
Date	1 November 2015 - 30 October 2018
Title of qualification	PhD
Name and type of organization	University of Rome “Tor Vergata” - Pervasive Electromagnetic Lab
Date	1 November 2017 - 31 May 2018
Title of qualification	PhD International
Name and type of organization	ETH Zurich
Date	13 January 2016
Title of qualification	Graduation to Professional Engineer
Name and type of organization	Ordine Nazionale degli Ingegneri
Date	1 April 2015 – 31 October 2015
Title of qualification	Researcher
Name and type of organization	CNR – Consiglio Nazionale delle Ricerche
Date	15 February 2015 – 20 February 2015
Title of qualification	Visiting Researcher
Name and type of organization	ESRF – European Synchrotron Radiation Facility

Date	17 December 2014
Title of qualification	Master Degree in ELECTRONIC ENGINEERING
Name and type of organization	Università Politecnica delle Marche – Facoltà di INGEGNERIA
Level international classification	2 nd level degree – Master
Age at Graduation	24
Official time limit for the course	Two years
Degree mark	110/110 with honours (17/12/2014)
Thesis title	DESIGN OF BIMODAL DIRECTIONAL COUPLERS AND PHASE SHIFTERS FOR APPLICATIONS IN COMPACT BEAM FORMING NETWORKS
Thesis abstract	The main object of the thesis is the design of beam forming networks made up of 2N-port couplers (N>2) in such a way as to reduce the number of layers necessary to obtain the required division. In this context one key point is given by the matching network, which should be capable to match simultaneously all the inputs. Indeed, the solution of this problem exists only for very few cases, including 4-port doubly symmetric directional couplers and 1:N dividers with rotational symmetry. The generalization to a multiport case is this specific task.
Date	1 April 2014 – 31 August 2014
Title of qualification	Young Researcher Trainee
Name and type of organization	ESA – European Space Agency
Date	20 October 2012
Title of qualification	Bachelor Degree in ELECTRONIC ENGINEERING
Name and type of organization	Università Politecnica delle Marche – Facoltà di INGEGNERIA
Level international classification	1 st level degree – Bachelor
Age at Graduation	22
Official time limit for the course	Three years
Degree mark	104/110 (20/10/2012)
Thesis title	ANALYSIS AND DESIGN OF ELECTROMAGNETIC SYSTEMS FOR AID TO WALKING FOR VISUALLY IMPAIRED ATHLETES
Thesis abstract	The thesis describes a research project, which saw the participation of the “ <i>Universidad Politecnica de Valencia</i> ”. The first part is about the use of RFID sensors programmed and positioned in strategic places as an aid to impaired athletes during a race. Through these sensors positioned along the route of the marathon, the athlete can run alone, guided by the instructions stored in the RFID. Such instructions are read through a Bluetooth receiver dressed by the runner. The second part concerned the design and the practical realization of a helical antenna, driven by a portable network analyzer, that allows seeing in front of the athlete. The final solution provides a hybrid system of these possible applications.
Date	June 2008
Title of qualification	Trainee at Polytechnic of Milano
Name and type of organization	HI-TEC project for only 100 high school students from all Italy at POLIMI, Milan
Date	11 July 2009
Title of qualification	Secondary school diploma
Name and type of organization	Liceo Scientifico “Giacomo Leopardi”, Recanati
Age at Graduation	19
Official time limit for the course	Five years
Thesis title	The Aurea Section in History, Art, Life, Literature and Philosophy



PERSONAL SKILLS

Mother tongue Italian

Other language(s)

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	Excellent	Excellent	Excellent	Excellent	Excellent
French	Good	Good	Good	Good	Good

Journal Papers

[1] M. Longhi and G. Marrocco, "Ubiquitous Flying Sensor Antennas: Radiofrequency Identification Meets Micro Drones," in *IEEE Journal of Radio Frequency Identification*, vol. 1, no. 4, pp. 291-299, Dec. 2017, doi: 10.1109/JRFID.2018.2801882.

Abstract: Tag-copter is an architecture of dynamic and self-relocating sensor devices originating from the synergy between sensor-oriented radiofrequency identification (RFID) and the emerging micro air vehicles technology. Tag-copters integrate a low-cost nano multi-copter with a miniaturized RFID data-logger antenna for the ubiquitous and cooperative monitoring of indoor volumes as well as of harsh environments. This concept is preliminary exploited by means of a theoretical formulation to derive the upper-bound performance of a flying "winged sensor." The analysis addresses the sensing accuracy versus the flight speed and the reliability of the on-the-flight data exchange with a fixed base-station through backscattering modulation. A first working 16 g prototype, capable of temperature measurement and storage, is experimented in a controlled setup to corroborate theoretical and experimental findings. The same device is then applied in realistic conditions concerning the temperature mapping within indoor environments. Preliminary results demonstrate that the maximum temperature measurement error is of the order of 1 °C along flight trajectories of 30 m. Finally, most of the data stored within the datalogger memory can be correctly uploaded by a flying tag-copter toward a fixed reader provided that the copter flies at approximately 1 - 1.5 m from it.

URL: <https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8281505&isnumber=8294008>

[2] G. Casati, M. Longhi, D. Latini, F. Carbone, S. Amendola, F. Del Frate, G. Schiavon, G. Marrocco, "The Interrogation Footprint of RFID-UAV: Electromagnetic Modeling and Experimentations," in *IEEE Journal of Radio Frequency Identification*, vol. 1, no. 2, pp. 155-162, June 2017, doi: 10.1109/JRFID.2017.2765619.

Abstract: The combined use of unmanned aerial vehicles (UAV) and radiofrequency identification (RFID) devices is an emerging topic of the environmental monitoring, which combines the versatility of multi-copter airframes with the potentiality of low-cost wireless sensors. This paper introduces some performance metrics suitable to quantify the capability of an RFIDrone to scan a surface equipped with radio-sensors. By using simple propagation models, an optimal drone-surface distance is mathematically derived at the purpose to maximize the electromagnetic footprint for the specific choice of system parameters, such as the sensor type and position, the reader sensitivity, the ground reflectivity, the radiated power, and the flight velocity. Theoretical achievements and some preliminary experimentations indicate that omnidirectional antennas are preferred for the drone so that 9-12 m footprints could be achieved with state-of-the-art readers and battery-less or battery-assisted RFID sensors, provided that the UAV flights at 3-5 m from the surface to be monitored. In this condition, the hit-rate of arrays of tags is better than 90% for a flying speed less than 1.8 km/h. The read performance is instead sensibly degraded by the presence of multi path in case of sensors spaced out the surface.

URL: <https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8082513&isnumber=8241467>

[3] S. Fiocchi, M. Longhi, P. Ravazzani, Y. Roth, A. Zangen, M. Parazzini, "Modelling of the Electric Field Distribution in Deep Transcranial Magnetic Stimulation in the Adolescence, in the Adulthood, and in the Old Age", *Computational and Mathematical Methods in Medicine*, vol. 2016, Article ID 9039613, 9 pages, 2016, doi: 10.1155/2016/9039613.

Abstract: In the last few years, deep transcranial magnetic stimulation (dTMS) has been used for the treatment of depressive disorders, which affect a broad category of people, from adolescents to aging people. To facilitate its clinical application, particular shapes of coils, including the so-called Hased coils, were designed. Given their increasing demand and the lack of studies which accurately characterize their use, this paper aims to provide a picture of the distribution of the induced electric field in four realistic human models of different ages and gender. In detail, the electric field distributions were calculated by using numerical techniques in the brain structures potentially involved in the progression of the disease and were quantified in terms of both amplitude levels and focusing power of the distribution. The results highlight how the chosen Hased coil (H7 coil) is able to induce the maxima levels of **E** mainly in the prefrontal cortex, particularly for the younger model. Moreover, growing levels of induced electric fields with age were found by going in deep in the brain, as well as a major capability to penetrate in the deepest brain structures with an electric field higher than 50%, 70%, and 90% of the peak found in the cortex.

URL: <https://www.hindawi.com/journals/cm/mm/2016/9039613/>

[4] M. Longhi, Z. Taylor, M. Popović, J. Nieto, G. Marrocco and R. Siegwart, "RFID-Based Localization for Greenhouses Monitoring Using MAVs," *2018 IEEE-APS Topical Conference on Antennas and Propagation in Wireless Communications (APWC)*, 2018, pp. 905-908, doi: 10.1109/APWC.2018.8503764.

Abstract: This paper presents a localization method for Micro Aerial Vehicles (MAVs) equipped with RFID sensors for the monitoring of small indoor areas such as greenhouses. After validating the localization procedure, we perform some experiments aimed to produce thermal mapping in an indoor environment to control and prevent anomalous changes for the plant safety. Moreover, the accuracy of our RFID based localization method is evaluated by comparison with Maplab and Vicon systems, two precise but expensive localization method. We obtained a localization accuracy of $\sigma = 0.12$ m as standard deviation for the RFID localization system, that could be considered adequate for a greenhouse.

URL: <https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8503764&isnumber=8503665>

[5] M. Longhi, A. Millane, Z. Taylor, J. Nieto, R. Siegwart and G. Marrocco, "An Integrated MAV-RFID System for Geo-referenced Monitoring of Harsh Environments," *2018 IEEE Conference on Antenna Measurements & Applications (CAMA)*, 2018, pp. 1-4, doi: 10.1109/CAMA.2018.8530596.

Abstract: Micro Aerial Vehicles (MAVs) equipped with lightweight Radio Frequency Identification (RFID) sensor data-loggers, have the potential to assist in achieving environmental awareness in a large range of situations. However, in order to gain such insight, the system must be able to accurately localize itself and fuse any readings of its surroundings into a consistent map. In this paper we demonstrate how camera, IMU and environmental data obtained with an RFID-enabled temperature sensor may be merged together to create accurate 3D maps along the MAV curvilinear trajectories in unknown locations. The idea is demonstrated through experimentations in both indoor and outdoor harsh environments.

URL: <https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8530596&isnumber=8530450>

[6] M. Longhi and G. Marrocco, "Flying sensors: Merging Nano-UAV with radiofrequency identification," in *2017 IEEE International Conference on RFID Technology & Application (RFID-TA)*, 2017, pp. 164-168, doi: 10.1109/RFID-TA.2017.8098875.

Abstract: The concurrent evolutions of micro/nano Unmanned Aerial Vehicles (UAVs) and sensor-oriented Radio frequency identification (RFID) technology, prompts the idea of winged-tags for a ubiquitous and dynamic monitoring of harsh environments and of large indoors spaces. It is here described and experimentally characterized the concept of Tag-Drone comprising a low-cost nano-quadcopter and a miniaturized RFID tag having temperature sensing capability. The weight of the RFID sensor is compatible with the modest payload of the quadcopter, and it can be interrogated up to three meters. A simple experimental procedure, involving a reproducible guided flight of the Tag-Drone, is hence described to estimate the visibility time windows with respect to a base station for on-the-flight data exchange in case of different operational modes.

URL: <https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8098875&isnumber=8098637>

[7] M. Longhi, J. Galdeano, A. Morini, M. Baldelli, P. Angeletti, G. Toso, G. Venanzoni "Dual-polarization beam forming networks based on high order directional couplers," *2017 11th European Conference on Antennas and Propagation (EUCAP)*, 2017, pp. 2820-2823, doi: 10.23919/EuCAP.2017.7928694.

Abstract: A Ka-band dual-polarization 3 dB directional coupler is designed for Beam Forming Network applications. The proposed solution is particularly suited for compact Nolen networks. Nolen architecture is attractive because it is planar and lossless. Two parallel square waveguides are coupled through an array of apertures, designed to get the desired coupling and high isolation between the two orthogonal polarizations.

URL: <https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=7928694&isnumber=7927946>

[8] M. Longhi, G. Casati, D. Latini, F. Carbone, F. Del Frate and G. Marrocco, "RFIDrone: Preliminary experiments and electromagnetic models," *2016 URSI International Symposium on Electromagnetic Theory (EMTS)*, 2016, pp. 450-453, doi: 10.1109/URSI-EMTS.2016.7571423.

Abstract: We introduce in a unitary way the paradigm of radiofrequency identification (RFID) merged with the technology of Unmanned Aerial Vehicles (UAV) giving rise to RFIDrone devices. Such family comprises the READER-Drone, which is a suitable UAV integrated with an autonomous RFID reader to act as mobile scanner of the environment, and the TAG-Drone, a UAV only equipped with an RFID sensor tag that hence becomes a mobile and automatically re-positioned sensor. We shows some handy electromagnetic models to identify the upper-bound communication performance of RFIDrone in close proximity of a scattering surface and we resume the results of some preliminary open-air experimentation corroborating the theoretical analysis.

URL: <https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=7571423&isnumber=7571290>

Technical skills and Competence I am an Electronic Engineer, an extremely determined person with a strongly orientation to achieve ambitious objectives. In each step of my career, I had spent long periods in international contests to enrich my experiences and skills. During the master's I moved to the European Space agency. In the Netherlands, I started to assess my university background in such a stimulating and prestigious contest. Also, during the PhD, I moved in an international contest: the ETH in Zurich, one of the best universities in the world. In Switzerland, I enhanced my ability in team building and problem solving, managing many projects, and supervising students. For the same reason, achieving the PhD, I collaborated with the IDEA spinoff: a young and stimulating environment, where I had worked in an international contest for innovative projects. Then, I moved to a multinational enterprise, the MVG company with worldwide production, service and sales, and significant background in problem managing, international relations and high internal capabilities.

I am an expert on antenna design, realization, and measurement. Thanks to my previous experiences, I have many scientific contacts in Europe, in the major research centers and I have the ability of create profitable research connections. I am able to collaborate and relate from local to international projects. The PhD period was very exciting, in particular, for the possibility to works in a laboratory in which was possible to compare the theoretical study with real problem of physical prototypes. I token part to a CST course, and it allowed me to better approach the antenna simulation challenges. I realized some RFID nano antenna prototypes with cutter copper and PVC, able to be integrated with a 3V battery and works in data logger modality. Working on small dimension antenna is an exciting challenge. During the CNR work period, I designed with some simulation software such as SEMCAD-X and Sim4Life to simulate the electromagnetic devices on the human body. Moreover, during the ESA trainee period, I used Microwave software simulation to design and optimize the project. In particular, I learned to use HFSS, CST, μ Wave Wizard.

INFORMATION & TECHNOLOGY SKILLS

Computer skills

- Operating system:** Excellent
- Programming language:** Very Good
- Word processing:** Excellent
- Electronic spreadsheet:** Excellent
- Data base administrators:** Excellent
- Web site creator:** Good
- Multimedia:** Excellent
- Programming languages known:** C, C++, Assembly, Matlab, Arduino, Android, SQL
- Software:** HFSS, CST, Sim4Life, SEMCAD-X, μ Wave Wizard, Fest 3D, maplab

ECDL (European Computer Driving Licence) certificate: Yes

CST courses: "Microwave and Antenna Training", October 2016
"Microwave and Antenna", September 2019