# Vivek **Radhakrishnan**


Senior Robotics Research Engineer

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## Summary


Proactive Robotics researcher and engineer specialized in autonomous unmanned aerial vehicles with 10+ years of experience delivering multiple industrial solutions, including long-range GPS denied navigation for unmanned aerial systems as well as heterogeneous swarms of aerial robots for maximum area coverage. Driven by an ongoing quest for knowledge and a dedication to solving complex challenges with exceptional proficiency across both hardware and software domains.


## Education

### Masters (New York University, Tandon School of Engineering)

*New York, USA*

M.S. in Mechatronics and Robotics Engineering — *2021 - 2023*

- 2 years research experience at Agile Robotics and Perception Lab under Prof. Giuseppe Loianno

### Bachelors with Honors (Birla Institute of Technology and Science)

*Dubai, UAE*

B.S. in Electrical and Electronics Engineering — *2010 - 2014*

## Skills

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|---|---|
| **Programming** | C++, C, Embedded C, Python, Bash, C#, .NET, VHDL, Verilog |
| **Softwares** | ROS, Unity3D, Arduino, STM32Cube, Vim, Keil, Matlab, OpenSCAD, KiCAD, Git, Jenkins, Docker, Xilinx ISE |
| **Hardware** | PCB Design, Embedded system circuit design, SMD/Through hole soldering |
| **Embedded Systems** | PX4, Crazyflie, STM32, VOXL, NVIDIA Jetson, Raspberry Pi, Xilinx Spartan |

## Work Experiences

### ZEROFLAi

*New York, USA*

Co-Founder & CEO — *Jul. 2023 - Present*

Bridging drone innovation from research to industry

- **Autonomous charging system** for UAVs for perpetual autonomous missions without a human in the loop

### Technology Innovation Institute

*Abu Dhabi, UAE*

Senior Researcher Hardware Design — *Jul. 2020 - Aug. 2023*

Worked as a **research engineer** building **state of the art autonomous UAVs** (**fixed wings**, **multirotors** and **VTOLS**)

- **Fully automated system design** for test platforms - **Quadcopter** and **FixedWing VTOL**
- Unified **control architecture** for **quadcopters** and **fixed wings**
- Implemented **non linear controller** and **planner** for high speed **aggressive quadcopter** flights greater than **100miles per hour**
- Multi sensor fusion using an **Unscented Kalman Filter**
- Designed a cascaded multi filter approach (**EKF** & **PDAF**) to **track incoming objects** while removing false positives
- **Mission commander** with tight integration with **QGroundControl**
- Custom **UI** for **commander** and **control** modules
- Full hardware system design

### Algorythma Autonomous Aerial Labs

*Abu Dhabi, UAE*

Systems Integration Engineer — *Oct. 2018 - June. 2020*

Worked as the system integration engineer in the Autonomous Aerial Lab of Algorythma. Designed and implemented cutting edge control, state estimation, perception and other critical subsystems which were implemented on the aerial platform.

- Developed a **unified swarming subsystem** to command or control the UAVs
- Designed and implemented a **geometric controller** for **trajectory tracking**
- Designed a **minimum snap trajectory generator** and sampler
- Built a custom **sensor fusion** system using EKF
- Designed and implemented a **globally consistent state estimation** for swarming application
- Implemented an **online 3D mapping** using RGBD camera
- **Custom designed a GUI** for feedback and control
- Developed **scripts for easy system setup**
- Implemented **CI** for important subsystems using **Jenkins** and **Docker**
- **PCB design** and development for different subsystems

### BUT nv.

*Dubai, UAE*

Hardware Developer / Lead Hardware Engineer

*May. 2015 - Sept. 2018*

BUT nv is an interactive media company. Promoted to the role of lead hardware engineer on December of 2017. The projects I was involved in are as follows.

- Built **RC car** with **FPV** and lap timer which was controlled with steering wheel and used for **racing**
- Backend implementation for an in house **Robotic AI assistant**
- Implemented **control** of **ABB Yumi robotic hand** using Playstation controller at MWC 2018
- Created an **interface** that connected **Unity 3D** with **ABB Yumi** using RAPID
- Built a **touchscreen** using a **Hokuyo Lidar** and integrated with in house content
- Designed and built **4D Virtual Reality** systems which would trigger additional experience like water mist, scent, rumble etc
- **Reverse engineering** of black box systems
- Developed **custom software** for **holographic fans**, which allow multiple fans to sync content and display a large format video
- Designed the **networking protocols** and seamless **player tracking** for a **multiplayer virtual reality** experience
- Implemented **user tracking** in a **large scale interactive Augmented Reality** project
- Used **Crazyflie 2.0** as an autopilot for a **swarm** of 6 mini quadcopters in a **dance**
- Integrated **custom sensors** in the **smart mirror** platform to detect parameters like height, weight, temperature, breathing rate etc
- Created **6dof trackable paper** to be used as control for a projection mapping table
- Implemented and merged **face analytics API** into in house solutions
- Built a prototype concept for the **smart living room**, with features that include key finder, knock controller, smart wallpaper etc
- Full **6DOF tracking** of an object using **PNP algorithm** and a single camera
- Designed and implemented a software to analyze and **add motion to 360 video**
- **Server maintenance** and optimization for the Guzzle app
- Built and delivered **workshop** for university students that include **OpenCv, Arduino** and using microcontrollers with computers
- Built an **object detection/recognition** api using **machine learning** for Unity 3D

### The Assembly

*Dubai, UAE*

In House Engineer

*Oct. 2014 - May. 2015*

As the in house engineer of the Assembly my job was to build amazing projects and deliver workshops on different topics like Robotics, IOT etc. The workshops presented are as follows

- **Basics of IOT** - The scope of this workshop was to give an introduction on IOT, IOE and introduce the AllJoyn library from Qualcomm
- **Advanced IOT** - This workshop was to continue where we left off on the previous workshop and introduce and teach the library
- **Learning Computer Vision** - In this session the goal was to introduce OpenCV and teach the basic Image Processing functions and implement simple algorithms
- **Learning Gesture Control** - This program introduces people to the Leap Sensor and shows them how to leverage the hand tracking library to control robots
- **Basics of UAVs** - This workshop introduces the participants to UAV's and tells them about the basic concepts of flight, control etc. They are also given DIY kits and told how to assemble and quadcopters.
- **Smart Home Automation** - It introduced the Arduino Platform and how to leverage it to detect environmental changes using sensors and react accordingly
- **DIY Security Camera** - This workshop uses OpenCV optical flow algorithm to detect movement and take a video and upload it on the cloud.
- **How do Robots See** - Implementing an obstacle avoidance algorithm and improving it was the main objective of this workshop

### Etisalat.

*Dubai, UAE*

UAV Engineer

*Dec. 2014 - Feb. 2015*

After the success of the UAV project in GITEX 2014, Etisalat entered the Drones for Good Award, where we won the 1st place. There were 2 projects submitted. One was a portable RF station/monitor. The second one was using drones to transport polio vaccines to remote locations.

- Developed a **path planning** and **obstacle avoidance** algorithm
- Implemented **non linear control system** for low power consumption flights
- Designed an **autonomous charging** scheme and **route optimizations** for long endurance flight
- Interfacing the sensor stack and Etisalat modem with the controller
- Full software stack development

### Etisalat.

*Dubai, UAE*

UAV Engineer

*Aug. 2014 - Oct. 2014*

Worked as a consultant and developer for the Drone aspect of the Smart City Project. My responsibilities were

- Develop a **multi-rotor platform** for carrying heavy payloads
- Programming the customized controller
- Implemented **3D terrain mapping**
- Designed and implemented **control system**
- Integration of **sensor stack** with **controller**

### Samsung and Acer

*Dubai, UAE*

Promoter

*Feb 2013 and Oct 2012*

Worked as a Promoter for Samsung in Gitex Shopper 2013 and Acer in Gitex Shoppers 2012

## Peer-Reviewed Publications

**Unifying Foundation Models with Quadrotor Control for Visual Tracking Beyond Object Categories** — *Yokohama, Japan*

IEEE International Conference on Robotics and Automation (ICRA) 2024 — *May 2024*

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**Directed Graph Topology Preservation in Multi-Robot Systems with Limited Field of View Using Control Barrier Functions** — *New York, USA*

IEEE Access — *Dec 2023*

**AutoCharge: Autonomous Charging for Perpetual Quadrotor Missions** — *London, UK*

IEEE International Conference on Robotics and Automation (ICRA) 2023 — *May 2023*

**Vision-based Relative Detection and Tracking for Teams of Micro Aerial Vehicles** — *Kyoto, Japan*

IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2022 — *Oct. 2022*

**Challenges in Vision-based Drones Navigation at IROS 2019** — *Macao, China*

IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2019 — *Nov. 2019*

## Patents

**A system for charging a battery in an aircraft** — *U.S. Provisional Patent*

Provisional - Granted (No. 63/375,638) — *Sept, 2022*

**A system for charging a battery in an aircraft** — *U.S. Utility Patent*

Utility - Pending (No. 18/467,202) — *Sept, 2023*

## Extracurricular Activities

**Team IFOR** — *Dubai, UAE*

Engineer, Tech lead in 2012 — *2011 - 2014*

- Implementing Path Planning and Obstacle Avoidance on ROS
- Integrating other key software components with ROS
- Integration of all software with ROS
- Porting ROS to ARM
- Implemented Kalman Filter for sensor fusion
- Implemented 2D Exploration algorithm on ROS
- Implemented Non-Linear Control system

**College Projects** — *Dubai UAE*

Self project — *2010 - 2014*

- Design and implement a miniature fingerprint based attendance monitoring system
- Implementation of SLAM algorithm on a microcontroller with integrated DSP
- Design and implement an obstacle avoidance algorithm using Reinforcement learning on a UGV platform
- Harvesting usable energy from Piezo-Electric Crystals
- Implemented a multi sensor platform for automobile safety
- Design a simple math co-processor on a FPGA