

# BILAL ARAIN

## Senior Robotics Engineer (Perception Systems)

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*Academic and Industry experience in the field of robotics, aerospace, automation and control with emphasis on R&D. I develop advanced perception systems at the Dubai Future Labs for the last-mile autonomous delivery robots in collaboration with the local industry in the UAE.*

Education	Publications & Patents	Languages
2011 Certification in Machine Learning	● 26 research publications in peer-reviewed journals & conferences	● English: Fluent
2009 PhD Electrical Engineering		● Urdu: Fluent
2004 Graduate Certificate in Digital Control Systems	● 4 Patents	● Punjabi: Fluent
2001 BE (Hons) Industrial Electronics Engineering	● <a href="#">Google Scholar Link</a>	● Arabic: Functional

### Key Capabilities and Skills

- Demonstrated success in field robotics (aerial, marine, ground) projects and acquired international technical projects in the control, automation and mining industry in Australia.
- Software engineering and integration of the application layers to develop perception systems such as localization, sensing, mapping and interpretation of the complex environment.
- Unmanned system development, and prototyping, including high-fidelity modelling, vehicle guidance, navigation and control systems.
- Real-time and embedded systems development, including real-time extended state machines, robot operating systems, real-time open robot control software (OROCOS), path planning and remote operations.
- GPS/INS/Vision sensor fusion and integration using C/C++ in Windows and Linux environments.
- Demonstrated experience in Siemens industrial automation systems, including process control systems, SIMATIC S7/S5 based controllers, and WinCC based HMI systems.

### Key Achievements

- Demonstrated navigation, planning and control of a small unmanned helicopter in a GPS-denied environment using inertial and airspeed sensors for applications such as autonomous landing on moving platforms.
- Developed new products for autonomous tractor steering and implement control for precision agriculture applications.
- Developed situational awareness and mapping solution for coal stockpile in GPS-denied environment for the **Caterpillar D10T track-type tractors at the Gladstone Ports Corporation sites**.
- Developed a real-time terrain mapping solution for navigation of underwater vehicles in close proximity to the coral reef environment.

### Professional Experience

**September 2021 - present      Senior Robotics Engineer (Perception)      Dubai Future Foundation**

**Responsibilities:** As an external contractor, my role is to develop an intelligent and low-cost perception system for autonomous delivery robots and robotic manipulators, in collaboration with the local industry in the UAE. Indeed, I have developed novel market-ready low-cost perception systems for autonomous vehicles that can be deployed on the street in the UAE.

**2018 - September 2021      Postdoctoral Research Fellow      [QUT](#)**

**Responsibilities:** My role is to develop an advanced terrain detection system, in collaboration with the [Rheinmetall](#)

[Defence Australia](#), to solve complex navigation problems. In another project, my role was to develop navigation and perception algorithms for Autonomous Underwater vehicles to perform surveys in the challenging coral reef terrain of tropical Australia in collaboration with the Australian Institute of Marine Science. Accomplishments include:

- Created two novel approaches for [improving underwater obstacle detection using semantic image segmentation](#), published in IEEE International Conference on Robotics and Automation (ICRRA) 2019.
- Developed [close-proximity underwater terrain mapping using learning-based coarse range estimation](#), submitted in IEEE Robotics and Automation Letters (RAL), 2020.

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**2015 - 2018**

**Control Systems Engineer (R&D)**

**[AgJunction Inc.](#)**

**Responsibilities:** I was responsible for developing products by enhancing navigation, planning and control algorithms for precision agriculture machinery. Led research and development programs within the company to find innovative solutions for the customers such as [CLAAS](#). Accomplishments include

- [Vehicle control optimization](#) and [vehicle implement control](#)
- [Three-dimensional terrain mapping](#) and [predicting terrain traversability for a vehicle](#)

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**2014 - 2015**

**Software Engineer (R&D)**

**[Topcon Positioning Systems Inc.](#)**

**Responsibilities:** Developed firmware for mining machinery to solve unique customer problems. Accomplishment include:

- Design and implement dead reckoning system for Caterpillar D10 dozer in GPS denied environment using inertial sensors for coal stockpile operations
- Design and implement blade control system for motor graders
- Developed new product for the Caterpillar 120M motor grader blade attitude estimation system

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**2012 - 2014**

**Postdoctoral Research Fellow**

**[OUT](#)**

**Responsibilities:** Accountable for R&D as part of [project ResQu](#) for design, development and integration of automated emergency landing systems for general aviation aircraft. Accomplishment include:

- [Enabling aircraft emergency landings using active visual site detection](#), published in Field and Services Robotics (FSR), 2013
- Developed [autonomous forced landing system for light general aviation aircraft in unknown environments](#), published in Australian Control Conference, 2013.
- Design, develop and implement the path planning algorithm to generate a risk free path for emergency landing

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**2009 - 2012**

**Postdoctoral Research Fellow**

**[CSIRO](#)**

**Responsibilities:** Worked on a wide range of R&D projects for Unmanned Aircrafts Systems (UAS), these projects covered multiple facets of optimisation and control for both industrial and military applications. Accomplishment include

- [Smart Skies project](#)
- [Real-time wind speed estimation and compensation for improved flight](#) in GPS-denied environment
- Vision-based launch and recovery of unmanned aircraft from autonomous boat
- Design and development of unmanned aircraft for low-altitude imaging of vegetation and environmental monitoring based on Hyper-spectral Imaging System

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**2009 - 2009**

**Research Fellow**

**[The University of Newcastle](#)**

**Accomplishments:**

- Developed negative imaginary controller for [atomic force microscopy with a 12-electrode piezoelectric tube scanner](#), published in Review of Scientific Instruments, 2009.
- Design and implementation of a robust controller for a dual-stage hard disk drive.

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**2009 - 2005**

**Manager (Technical)**

**[Marine Systems Ltd](#)**

**Accomplishments:**

- Provide technical solutions to complex naval problems (Maritime operations), specifically problems arising due to obsolescence or absence of support from OEM
- Design and conduct comprehensive tests and trial procedures of the prototypes products in close collaboration with the user to ensure reliable and trouble-free operation in the intended environment.