Gabriel F P Araújo

Autonomous System Engineer

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Nothing in life is to be feared, it is only to be understood
Marie Curie

Skills

Expert skills

Hardware	Robotic Sensors (Perception, Localization), Sensor Integration, Hardware Debugging
Algorithms	Autonomous System Testing, Kalman Filters, Vehicle Control, Obstacle Avoidance, Path Planning
Systems	Development Models, Field Experiments, Control Systems, Robot Simulation

Development

Languages	C, C++, Python, JavaScript	Frameworks	ROS1/2, Autoware
DevOps	Git, Unit Testing, Docker	Tools	CMake, GDB
Libraries	ROS Navigation, BehaviorTree.CPP, PyTrees, OpenCV, PCL, Eigen, FreeRTOS		
Applications	MATLAB, SolidWorks, Blender, Inkscape		

Education

2022 – 2024 **MSc in Computer Science**, *University of Brasília*, Brasília, Brazil
Coursework: Digital Signal Processing, Artificial Intelligence, Software Engineering

2012 – 2021 **BSc in Mechatronics Engineering**, *University of Brasília*, Brasília, Brazil
Coursework: Control Theory, Robot Control, Computer Science for Robotics, Real-time Processing

Master thesis

Title *Trace-Diagnostic for Signal Temporal Properties: an Evolutionary Approach*

Supervisor Professor Dr. Genaína Nunes Rodrigues

Description This thesis explores the diagnosis of system requirements using trace-checking techniques combined with a genetic programming-based approach for autonomous systems such as *mobile robots*, and *self-driving cars*.

Experience

April 2023 – Present **Autonomous System Engineer**, *Danfoss Power Solutions*, Nordborg, DK, Full-time

Outline I work as a System Engineer for a world-class provider of mobile hydraulic and electrification products and solutions based at its headquarters in Denmark. My role is to create and validate system solutions for autonomous off-highway machines. My responsibilities include the development of system specifications, along with the development and execution of system test plans.

Key Achievements
- Requirements analysis
- Testing
- R&D

April 2025 – Present **Visiting Researcher (remote)**, *Gran Sasso Science Institute*, L'Aquila, IT, Contract

Outline As a visiting researcher, I participate in the project *Digital twin construction through a robotic arm*. Using a 3D scanner attached to the robotic arm, we digitize an art piece.

Key Achievements
- 3D reconstruction
- Motion control
- Path Planning
- Obstacle avoidance
- Safety Architecture and Development

April 2022 – March 2023 **Robotics Engineer (remote)**, *Smoob BV*, Leeuwarden, NL, Full-time

Outline I was the leader of the robotics engineering team at a self-driving car startup, where I was responsible for overseeing the entire autonomous vehicle software stack development process. This involved planning, prototyping, and implementing innovative solutions to improve vehicle autonomy. I also handled stakeholder communications and conducted thorough requirement analyses to ensure that our work aligned with the project's goals.

Key Achievements
- Successfully developed and integrated Perception and Planning modules using Autoware and ROS.
- Engineered a proprietary Simultaneous Localization and Mapping (SLAM) algorithm.
- Spearheaded the selection and design of critical algorithms and tools.

Jan 2022 – March 2022 **Robotics Consultant (remote)**, *Smoob BV*, Leeuwarden, NL, Contract

Outline Consultant for an early-stage start-up based in the Netherlands. Responsible for setting up demonstrations for investors and solving technical issues.

Key Achievements
- Remotely checks and sensor set up for a self-driving car prototype.
- Set up Autoware.AI stack to run demonstrations for stakeholders.
- Solving errors and installation issues regarding ROS and other libraries.
- Advisement about technical solutions.

Dec 2021 – March 2022 **Jr Robotics Software Engineer**, *Automni*, São Paulo, BR, Full-time

Outline Played a pivotal role in deploying and optimizing robotic systems at a major logistics start-up, supporting a multinational client's distribution center operations. Progressed from intern to full-time engineer, with responsibilities that included executing on-site tests, validating robotic performance, and troubleshooting system issues on-site to ensure seamless integration.

Key Achievements
- Development and integration of object detection module using 2D Laser and PCL.
- Robot calibration, configuration, testing, and validation on-site.
- Document issues and faults during testing, validation, and test results.
- Suggestion of corrections and bug fixes to both hardware and software.
- Hardware maintenance of the deployed robots.

May 2020 – Dec 2021 **Robotics Developer intern (*remote*)**, *Automni*, São Paulo, BR, Internship

Outline Worked as a robotics intern at a leading Brazilian start-up in logistics. Responsible for maintaining and documenting the code base and helping the engineering team add new project features.

Key Achievements
- Development of the order management system for multi-robots.
- Addition of new behaviors into the robot's Behavior Tree using BehaviorTree.CPP library.
- Integration of the client's system to send orders to the robots.
- Development of a User Interface in ReactJS for interacting with the robots using Roslibjs.
- Feature addition and bug fixing in the company's multi-robot route planner.
- Integration of 2D Laser security areas into ROS using OpenCV.
- Documentation and testing.

April 2019 – June 2019 **Embedded Developer intern**, *LandSense Soluções Tecnológicas*, Brasília, BR, Internship

Outline Worked on developing a new product in a Brazilian start-up as an undergraduate student. Responsible for prototyping the new product and its validation.

Key Achievements
- Design and implementation of a Bluetooth mesh protocol using Bluetooth® 4.0.
- Field testing for the mesh communication.
- Embedded software development using the Nordic nRF52832 microcontroller and RTOS.
- Main technology: C/C++.

July 2015 – April 2019 **Undergraduate Researcher**, *LARA (Automation and Robotics Laboratory)*, Brasília, BR

Outline Worked in a robotics research laboratory at the University of Brasília as an undergraduate student. Responsible for maintaining the robots and helping the researchers to run experiments.

Key Achievements
- Implement an indoor localization system using Cameras, Augmented Reality (AR) markers, OpenCV, and EKF.
- Firmware development for an Inertial Navigation System (INS) using STM32F103C8 development board.
- Development of an environment explorer using State Machines and ROS Navigation stack.
- Implementation of ROS drivers for GPS and IMU sensors.
- Also engaged in other research projects in robotics, specifically on multi-robot control and navigation.

Projects

March 2025 – Feb 2026 **CHANGES – Cultural Heritage Active Innovation for Sustainable Society**, *Digital twin construction through a robotic arm*

The project

April 2022 – July 2024 **Theodore-D: Search-based Trace Diagnostic**

The manuscript introduces a new trace-diagnostic technique for CPS requirements, called Search-Based Trace-Diagnostic (SBTD). Unlike existing techniques, SBTD utilizes evolutionary search. SBTD begins with a set of initial candidate diagnoses, then applies an evolutionary algorithm iteratively to generate new candidate diagnoses through mutation, recombination, and selection. A fitness function is used to evaluate the quality of these solutions. We assessed the performance of SBTD by considering combinations of traces and requirements that led to a violation of a property, and by evaluating the effectiveness of SBTD in producing informative diagnoses and its efficiency in terms of the time required to generate them. Manuscript is available at arXiv:2406.17268.

Jan 2021 – Oct 2021 **MissionControl: An architecture for mission coordination of heterogeneous robots**

I was responsible for three main tasks: (i) Creating a simulation environment for multi-robot systems using *Blender*, *Fusion360*, *ROS Navigation* and Morse simulator in *Python* and *ROS1*. (ii) Developing a robotics action sequencer using *Behavior Trees* in *Python* and *ROS2*. (iii) Designing and implementing a test orchestration architecture based on Docker to autonomously run multiple experiments. Paper published in a major journal, available online at doi:10.1016/j.jss.2022.111363.

March 2019 – June 2019 **Autonomous Navigation System for a Car-like Robot**

Development of a navigation architecture for a car-like robot with four modules: (i) *Probabilistic roadmap (PRM)* for path planning, (ii) a simple trajectory generation algorithm, (iii) A non-linear automatic controller based on *Lyapunov theory* for path following, and (iv) *PID* for motor control. The navigation system was implemented in *C++14* in *ROS*, and it was deployed in a simulated robot in *Gazebo* simulator for testing.

May 2017 – Aug 2017 **Expansion of the GNSS-SDR software to GLONASS system**, *Google Summer of Code 2017 participant with GNSS-SDR*

I have completed the implementation of the Acquisition and Tracking blocks in a GPS receiver for the GLONASS satellites. The goal of the Acquisition phase is to detect all the satellites visible to the antenna and determine their Doppler frequency. During the Tracking phase, the receiver continuously monitors the signals from the satellites to extract the navigation data. I have also added unit and system tests to the developed code for quality assurance. For more detailed information, please refer to the report available online. For more detailed information, please refer to the report available online at *click here*. The project was implemented in *C++14*. An article about the work has been published in the Inside GNSS magazine and can be accessed online, available at *click here*.

July 2014 – June 2015 **Need4SS: Autonomous Driver using Evolutionary Algorithm**

Development of an autonomous driver for the TORCS – an open-source 3D car racing game – to compete in the Simulated Car Racing Championship (SCRC), a former GECCO Competition. The implementation used *Finite-State Machine* in *C++11*. Later, we evolved the state machine parameters using a *Genetic Algorithm* to get the best driver possible with our approach. The driver got fifth place in the SCRC 2015. We published and presented the development and results as a conference paper, online available at doi:10.1109/SBGames.2015.19.