

Mohammed Abdelazim

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Publications

• AROLA: A Modular Layered Architecture for Scaled Autonomous Racing

IEEE Intelligent Vehicles Symposium (IV26), Detroit, Michigan, USA

- developed A modular, layered autonomous-driving architecture using ROS 2 to support scalable, reusable racing systems.
- Designed a full-stack driving pipeline integrating sensing, perception, localization, planning, behavior, control, and actuation layers.
- Developed *Race Monitor*, a real-time evaluation framework, was developed to benchmark controllers in simulation and real-world experiments.
- The system facilitated rapid controller comparison, efficient parameter tuning, and reproducible experiments across diverse platforms.
- The approach was validated by achieving **a 3rd place** finish at RoboRacer IV25 in Cluj, Romania.

Education

Technische Universität Berlin

External / Visiting Student, Institute of Technical Informatics and Microelectronics

Berlin, Germany

Mar 2026 – Aug 2026

Bachelor Thesis: Comfort-aware preview speed planning and control over speed bumps using LiDAR-based wheel excitation sensing

German International University in Berlin

B.Sc. in Mechatronics Engineering

Berlin, Germany

GPA: **0.92 (A+)**

Oct 2023 – Present

Relevant Coursework: Autonomous Systems, Control Systems Engineering, Power Electronics, Embedded Systems, Numerical Analysis, Thermodynamics, Fluid Mechanics, Software Engineering.

The German University in Cairo

B.Sc. in General Engineering

New Cairo, Egypt

GPA: **0.79 (A+)**

Sep 2022 – Aug 2023

Relevant Coursework: Advanced Calculus, Computer Science, Digital Logic Design, Physics III.

Honors & Scholarships

- GUC Scholarship for Outstanding Thanaweya Amma Achievement (2022)
- GUC Scholarship for Study Abroad in Germany (2023)

Research Experience

Multi-Robot Systems (MRS) Research Group

Research Intern

New Cairo, Egypt

Aug 2024 – Oct 2024

- Developed a quadrant drone using Embedded C, focusing on control algorithms and flight stability.
- Designed and implemented a PID controller in MATLAB/Simulink for precise stabilization.
- Reduced drone weight by 23% using SolidWorks, increasing flight time by 15%.

Professional Experience

CARIAD SE – A Volkswagen Group Company

Working Student – Software Engineer (ADAS/AD)

Berlin, Germany

May 2025 – Present

- Operate advanced test bench environments to measure and validate sensor data (LiDAR, radar, camera) for Automated Driving Systems.
- Develop, debug, and optimize test and measurement tools using C++ and Python on Ubuntu.
- Work with CI pipelines, CMake, and Conan for scalable build automation and dependency management.
- Author comprehensive technical documentation, ensuring clarity and traceability of test procedures.

Projects

F1TENTH Autonomous Racing Car

- Built a 1/10th scale autonomous race car on the F1TENTH platform, running ROS2 on NVIDIA Jetson.
- Implemented SLAM for real-time mapping and localization.
- Developed a Bezier spline-based path optimizer and **hybrid MPC–LQR controller** for trajectory planning.
- Implemented a dual Extended Kalman Filter (EKF) to fuse control inputs, IMU, and odometry data for accurate state estimation.
- Achieved **3rd place** in the 25th RoboRacer Autonomous Racing Competition, Romania.

TriFlameX: Swarm of Fire-Fighting Robots

- Developed 3 autonomous robots with multi-layer architecture (Laptop–ESP32–STM32) for coordinated detection and suppression of fires.
- Invented the interrupt-driven Azab Protocol for high-speed reliable binary communication in FreeRTOS.
- Designed a custom thermal LiDAR system for real-time fire localization.
- Integrated ROS2, MQTT, and UART for inter-robot and intra-robot communication.

Dice Realms: Quest for the Elemental Crests

- Developed a 2D board game in Java, with object-oriented programming (OOP) architecture.
- Implemented a finite state machine (FSM) to manage structured game flow and modular code architecture.
- Developed AI players using a Monte Carlo method for decision-making, supporting multiple difficulty levels and both human vs AI and AI vs AI gameplay.
- Designed UI in JavaFX and CSS; implemented version control with Git and GitHub.

Thyristor-Based Battery Charger Modeling and Rectifier Analysis

- Developed a MATLAB and Simulink toolkit for analyzing thyristor-controlled rectifiers and optimizing battery charging profiles.
- Simulated models for half-wave, full-wave center-tapped, and bridge rectifiers with adjustable firing angle control.
- Performed waveform analysis, power loss evaluation, and state-of-charge tracking for R, RL, and highly inductive loads using Simscape Electrical.

Skills

Technical: System Optimization, Hardware-Software Integration, API Documentation

Programming: Embedded C, C++, Java, Python, VHDL, Assembly, CSS

Operating Systems: Ubuntu, Arch Linux, Windows

Tools: ROS2, Git, MATLAB/Simulink, Quartus, Gazebo, Bash, PowerShell

Hardware Platforms: Raspberry Pi, NVIDIA Jetson, STM32, ESP32, Arduino, FPGA

Languages: English (C1), German (B2), Arabic (Native)

Interpersonal: Public Speaking, Leadership, Communication, Time Management

Certifications & Courses

- Robotics & Automation: ROS 2 Humble
- Machine Learning (DeepLearning.AI): Supervised & Unsupervised Learning, Recommenders, Reinforcement Learning, Advanced Algorithms
- Digitalization in the Aerospace Industry, Technische Universität München
- Mechanical Design: Siemens NX, Fusion 360, SolidWorks, AutoCAD
- Programming & Operation of 5-Axis CNC Machines
- Goethe-Zertifikat B2 (German)

Leadership & Activities

European Solidarity Corps for Youth (ESC4Y)

Biodiversity and Climate Action Volunteer

Deuselbach, Germany

Sep 2024 – Oct 2024

- Collaborated with IBG and the Foundation for Nature and Environment to support biodiversity (UN SDG 15) and climate action (UN SDG 13).
- Assisted park rangers in restoring peatlands in Hunsrück-Hochwald National Park.