

Abdulrahman Hamdy Ahmad

Ph.D. Candidate in Computer Science (AI & Autonomous Vehicles)

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Research Summary

■ Ph.D. candidate in Computer Science at Khalifa University, expected to graduate by Dec. 2026, specializing in autonomous driving stack and intelligent transportation systems. My research focuses on four connected themes:

- **Risk-aware and energy-efficient motion planning and control** for autonomous vehicles in mixed urban traffic, using probabilistic planning, online optimization, combinatorial optimization, mixed-integer programming, and competitive online algorithm design [5], [6].
- **Intelligent transportation systems and traffic-signal optimization**, including speed-profile generation algorithms, mixed-integer programming, and multi-objective optimization for increasing penetration of connected and autonomous vehicles, including prioritization for connected emergency vehicles [2], [4], [8].
- **Reinforcement learning and interaction-aware optimal control** for challenging control problems, combined with classical controllers such as full-state feedback, LQR, LQG, PID, and MPC, in applications to autonomous race cars, autonomous vehicles, and active suspension systems [7], [9].
- **Trajectory prediction and data-driven scene understanding** for autonomous driving, including dataset-creation pipelines and multi-task perception benchmarks [1], [3].

Education

2023 – 2026 (expected)

■ **Ph.D. in Computer Science**
(Full-time)

Khalifa University, Abu Dhabi,
United Arab Emirates.

- **Thesis:** Online risk-bounded motion planning for autonomous driving under uncertainty.
- **Current status:** Final-year Ph.D. candidate; completed all coursework with **CGPA 3.75/4.0** and currently focused exclusively on dissertation research.
- **Research focus:** Online optimization and algorithm design for risk-bounded motion planning and control of autonomous vehicles in uncertain, mixed-traffic environments. Modelled stochastic behaviour of other road users and jointly considered risk, energy consumption, passenger comfort, and battery constraints for electric vehicles, leading to the design of a risk-aware online planner based on competitive online and regret-bounded algorithms.
- **Development focus:** Implemented and evaluated multiple motion-planning stacks using CARLA, ROS 2, Foxglove, RViz2, Autoware, CommonRoad, RoadRunner, and MATLAB/Simulink (Autonomous Driving and Scenario Designer toolboxes). Collaborated on perception and data projects using vision-language models with OpenAI APIs and other LLMs, and developed tools for dataset collection, anonymisation, and perception pipelines.
- **Note:** Khalifa University is consistently ranked among the top 170 universities worldwide (QS World University Rankings).

Jan. 2021 – Dec. 2022

■ **M.Sc. in Electrical Engineering and Computer Science** (Full-time)

Khalifa University, Abu Dhabi,
United Arab Emirates.

- **Thesis:** Enhancing Internet of Things strategies for autonomous electric vehicles with existing transportation infrastructure and road users.
- **Research focus:** Designed machine-learning- and optimization-based strategies for traffic-signal timing at signalised junctions and analysed the impact of increasing penetration of connected and autonomous vehicles on intelligent transportation infrastructure. Formulated optimization approaches to reduce emergency-vehicle travel time in mixed-traffic environments with both human-driven and autonomous vehicles.
- **Development focus:** Built and evaluated microscopic traffic-simulation scenarios in PTV Vissim capturing realistic demand patterns and control strategies, and implemented several deep-learning models in Python using Keras and TensorFlow.
- Graduated with **CGPA 4.0/4.0** on Coursework and passed the thesis defense.

Education (continued)

Sep. 2012 – May 2016

■ **B.Eng. in Computers and Systems Engineering**
(Full-time)

Minya University, Minya, Egypt.

- Graduated with CGPA 3.2/4.0 and grade of Excellent in the graduation project.
 - **Graduation project:** *Software-defined architecture for industrial Internet-of-Things control of a lab-scale process.* Followed a complete research pipeline, from theoretical design to simulation in MATLAB/Simulink, IoT platform, and real-time implementation on a laboratory-scale testbed in the control lab.
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Employment History (2017-2026)

2021 – 2026 (+5 years)

■ **Graduate Research and Teaching Assistant**
(Full-time)

Khalifa University, Abu Dhabi,
United Arab Emirates.

- **Research Roles:**
 - M.Sc. (2021–2023) researcher in the Operations Research Lab, APEC Research Center, focusing on optimizing intelligent transportation systems. Studied the impact of increasing penetration of connected and autonomous vehicles and optimized emergency-vehicle travel time within intelligent transportation infrastructure. Worked with microscopic traffic simulation tools PTV Vissim and SUMO.
 - Ph.D. (2023–present) researcher in the Autonomous Vehicles Lab, KUCARS Research Center, focusing on on-line risk-aware and energy-efficient motion planning and control for autonomous vehicles in various traffic scenarios. Contributed to trajectory prediction research and full-stack autonomous vehicle development (autonomous race car and shuttle bus), including field testing. Worked with ROS 2, NAV2, CARLA, Autoware, MATLAB, and RoadRunner.
 - **Teaching and Supervision Roles:**
 - Assisted in teaching courses including Python Programming, MATLAB Programming, Data Analytics, Data Science with AI, Data Structures, Algorithm Design and Analysis, and Motion Planning Algorithms for Robotics using TurtleBot3 and ROS 2. For each course, my responsibilities encompassed curriculum development, delivery of lectures and administration of oral examinations, design of quizzes, and evaluation of student projects.
 - Co-advised one undergraduate senior design team developing a navigation stack for autonomous mobile robots (TurtleBot3, ROS2, SLAM, NAV2).
 - **Note:** *Khalifa University is consistently ranked among the top 170 universities worldwide (QS World University Rankings).*
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2019 – 2020 (1.5 years)

■ **Graduate Research and Teaching Assistant**
(Full-time)

Minya University, Minya, Egypt.

- **Research Role:** Conducted research on formal methods for mobile robots, symbolic control, and hybrid systems.
 - **Teaching and Supervision Roles:**
 - Assisted in teaching Discrete Mathematics, Signals and Systems, Intelligent Control, C Programming, and Computer-Controlled Systems. For each course, my responsibilities encompassed curriculum development, delivery of lectures and administration of oral examinations, design of quizzes, and evaluation of student projects.
 - Co-advised two undergraduate senior design teams developing IoT-based projects.
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2017 – 2019 (2 years)

■ **Reserved Officer (Military Service)**
(Full-time)

Egyptian Army, Egypt.

- In addition to military duties, participated in software engineering and embedded-systems development projects, including a CRM desktop application using C# and SQL Server and multiple graphical user interfaces for various pieces of equipment and machines.
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2018 – 2021 (3 years)

■ **Programming Instructor**
(Part-time)

(Minya & Giza), Egypt.

- Worked part-time at ElManara Academy (Minya, Egypt) and IGeek Academy (Giza, Egypt) as a programming instructor for more than three years.
 - Designed and delivered courses on C, C++, C# programming languages, Desktop applications, mobile robots, and Arduino programming for undergraduate students and professionals.
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Employment History (2017-2026) (continued)

2019 – 2021 (2 years)

■ **Software Engineer (Freelancer)**
(Part-time)

Al-manara Academy, Egypt, and
Online: (Upwork & Mostaq).

- Developed desktop, embedded, and IoT applications for clients (including projects via platforms such as Mostaq and Upwork) with consistently strong client reviews and positive feedback.

May, 2015 – Aug. 2015

■ **Embedded Systems Engineer (Internship)**
(Full-time-time)

Alfagr Advanced Systems, Giza,
Egypt.

- Contributed to the development of a large-scale embedded systems project, including firmware implementation, technical documentation, RTOS integration, and Android-based mobile application development.

Research Publications

Journal Articles

- 1 N. A. Madjid, **Abdulrahman Ahmad**, M. Mebrahtu, and M. Khonji, "Trajectory prediction for autonomous driving: Progress, limitations, and future directions," *Information Fusion*, vol. 126, p. 103 588, 2026, ISSN: 1566-2535. [DOI: https://doi.org/10.1016/j.inffus.2025.103588](https://doi.org/10.1016/j.inffus.2025.103588).
- 2 **Abdulrahman Ahmad**, A. S. Al-Sumaiti, Y.-J. Byon, and K. Alhosani, "Multiple intelligent control strategies for travel-time reduction of connected emergency vehicles," *IEEE Transactions on Intelligent Transportation Systems*, vol. 26, no. 1, pp. 337–353, 2025. [DOI: 10.1109/TITS.2024.3484771](https://doi.org/10.1109/TITS.2024.3484771).
- 3 N. A. Madjid, M. Mebrahtu, **Abdulrahman Ahmad**, and M. Khonji, "Emt: A visual multi-task benchmark dataset for autonomous driving," 2025. [DOI: 10.48550/arXiv.2502.19260](https://doi.org/10.48550/arXiv.2502.19260). arXiv: 2502.19260 [cs.CV].
- 4 **Abdulrahman Ahmad**, A. S. Al-Sumaiti, Y.-J. Byon, and K. A. Hosani, "Eco-driving framework for autonomous vehicles at signalized intersection in mixed-traffic environment," *IEEE Access*, vol. 12, pp. 85 291–85 305, 2024. [DOI: 10.1109/ACCESS.2024.3415495](https://doi.org/10.1109/ACCESS.2024.3415495).

Conference Proceedings

- 1 **Abdulrahman Ahmad**, M. Khonji, K. Elbassioni, J. Dias, and A. Al-Sumaiti, "Online risk-bounded graph-based local planning for autonomous driving with theoretical guarantees*," in *2025 IEEE International Conference on Robotics and Automation (ICRA)*, 2025, pp. 16 685–16 691. [DOI: 10.1109/ICRA55743.2025.11128187](https://doi.org/10.1109/ICRA55743.2025.11128187).
- 2 **Abdulrahman Ahmad**, M. Khonji, A. Al-Sumaiti, J. Dias, and K. Elbassioni, "Graph-based local planning with spatiotemporal risk assessment for risk-bounded and prediction-aware autonomous driving," in *2024 18th International Conference on Control, Automation, Robotics and Vision (ICARCV)*, 2024, pp. 485–492. [DOI: 10.1109/ICARCV63323.2024.10821596](https://doi.org/10.1109/ICARCV63323.2024.10821596).
- 3 **Abdulrahman Ahmad**, M. A. Radi, A. Ahmad, and A. Boudiaf, "Reinforcement learning-based optimal control design for active suspension systems," in *2024 Advances in Science and Engineering Technology International Conferences (ASET)*, 2024, pp. 1–6. [DOI: 10.1109/ASET60340.2024.10708702](https://doi.org/10.1109/ASET60340.2024.10708702).
- 4 **Abdulrahman Ahmad**, S. AlAmeri, Y. Ibrahim, and H. A. Marzouqi, "A machine learning approach for detecting unauthorized drone operators," in *2023 Advances in Science and Engineering Technology International Conferences (ASET)*, 2023, pp. 1–6. [DOI: 10.1109/ASET56582.2023.10180485](https://doi.org/10.1109/ASET56582.2023.10180485).
- 5 M. Moness, A. M. Moustafa, **Abdulrahman Ahmad**, and A.-S. A. Younis, "Hybrid controller for a software-defined architecture of industrial internet lab-scale process," in *2017 12th International Conference on Computer Engineering and Systems (ICCES)*, 2017, pp. 266–271. [DOI: 10.1109/ICCES.2017.8275316](https://doi.org/10.1109/ICCES.2017.8275316).

Skills

Research

■ Risk-aware and energy-efficient motion planning and control for autonomous vehicles; online optimisation; reinforcement learning and interaction-aware decision making; intelligent transportation systems and traffic management; trajectory prediction and data-driven scene understanding for autonomous driving.

Skills (continued)

Teaching	More than 7 years of experience as instructor and teaching assistant for courses including Python programming, C/C++/C#, data structures, data science with AI, motion planning for robotics (ROS 2), software engineering for robotics (ROS 2), discrete mathematics, automatic control, and mobile robotics / Arduino.
Leadership & Mentorship	Experience as a reserved officer in the Egyptian Army leading and coordinating teams; co-advising undergraduate senior design teams at Minya University and Khalifa University (autonomous robots and IoT-based projects); mentoring students in programming, robotics, and autonomous-vehicle projects in academic courses and training academies.
Programming	Python, C++, C#, MATLAB; ROS 2, CARLA simulator, RViz2; PTV Vissim; SUMO; Git and GitHub; $\text{\LaTeX}$.
Tools	Linux, Docker, VS Code, Jupyter; simulation and development tools for traffic and autonomous driving and autonomous robots (e.g., PTV-VISSIM, SUMO, Carla simulator, ROS2, NAV2, RoadRunner, Autoware, Gazebo).
Outreach & Exhibition	Exhibited autonomous-vehicle research and platforms as a representative of the Autonomous Vehicles Lab at major events, including Abu Dhabi Autonomous Week and the Dubai self-driving transport congress, engaging with industry, government, and public audiences.
Languages	Arabic (native); English (professional working proficiency).

Additional Information

Honours & Awards

2026	Recognized as a Future Expert on the UAE Research Map national platform, United Arab Emirates.
2025	Certificate of Recognition for serving as a Referee at RoboCup Asia-Pacific (RCAP) 2025 , Abu Dhabi, United Arab Emirates.
2023 – 2024	Elite Young Researcher , Khalifa University, Abu Dhabi, United Arab Emirates.
2024 – 2034	UAE Golden Visa holder for outstanding academic and research contributions.
2016	Funding prize ; received the graduation projects funding prize from Information Technology and Industry Development Agency (ITIDA), Egypt.

Research Passion

- Algorithm design and optimisation; risk-aware and energy-efficient motion planning and control of autonomous vehicles; intelligent transportation systems and traffic management in mixed-autonomy environments; reinforcement learning and interaction-aware optimal control; trajectory prediction and data-driven scene understanding for autonomous driving; AI and vision-language models for autonomous systems reasoning.

Selected Courses and Certificates

2026	Microsoft Learn for Educators: AI and Cyber-security bootcamp.
2023	Self-Driving Cars Specialization (Coursera). Four-course track: (1) Introduction to Self-Driving Cars; (2) State Estimation and Localization; (3) Visual Perception for Self-Driving Cars; and (4) Motion Planning for Self-driving Cars.
2020	Data Structures and Algorithms Specialization (Coursera). Five-course track: Algorithmic Toolbox; Data Structures; Algorithms on Graphs; Algorithms on Strings; Advanced Algorithms.
	IELTS overall band score 6.5 (out of 9).
	GRE Quantitative score 157 (out of 170).
2019	.NET Track , German Egyptian Academy (GEA), Egypt. Five-course sequence in C# and .NET development.
2015	Embedded Systems and RTOS certification (SAS).

Additional Information (continued)

Service and Reviewing

■ Research Reviewer

- **Journal reviewer:** IEEE Transactions on Intelligent Transportation Systems, IEEE Transactions on Industry Applications, and IEEE Access.
- **Conference reviewer:** IEEE International Conference on Robotics and Automation (ICRA), IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), and the International Conference on Control, Automation, Robotics and Vision (ICARCV).

Personal Details

- **Nationality:** Egyptian.
- Military service:** completed.
- Marital status:** married.
- Current residence:** Abu Dhabi, United Arab Emirates.

References

Dr. Majid Khonji

Assistant Professor Computer Science, Khalifa University, Abu-Dhabi, UAE. (Role: PhD main advisor).

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Prof. Young-Ji Byon

Professor of Civil Engineering, University of Missouri - St. Louis (UMSL), MO, USA. (Role: MSc advisor).

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Prof. Ahmad Mahmoud

Chair of Computers and Systems Engineering Department, Minya University, Minya, Egypt. (Role: main advisor for Bachelor's graduation project; co-advisor in postgraduate research.)

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**Additional references are available upon request.*