Basheer Al-Tawil

Ph.D. Candidate • Robotics & Human-Robot Interaction

Otto-von-Guericke-Universität Magdeburg, Germany

basheer.al-tawil@ovgu.de • linkedin.com/in/basheeraltawil • github.com/basheeraltawil • aibomech.com

Research Interests

Mobile robot navigation in human-populated environments • Visual SLAM and semantic scene understanding • Human action recognition for real-time edge deployment • Socially-aware motion planning and human-robot interaction • Deep learning for embedded robotics perception • LLMs.

Education

Otto-von-Guericke-Universität Magdeburg Aug 2023 – Present

Ph.D., Implicit Mobile Human-Robot Interaction — Faculty of Electrical Engineering and Information Technology *Magdeburg, Germany*

- Dissertation: *Social Navigation and SLAM with Human Behaviour Understanding*
- Supervisor: Prof. Dr. Ayoub Al-Hamadi, Neuro Information Technology.
- Funded by: BMBF AutoKoWAT-3DMAt, DFG SEMIAC, EFRE-ENABLING, EFRE-RoboLab, BMFTR Edison, ERDF-ORAKEL

İzmir Kâtip Çelebi University Feb 2020 – Feb 2023

M.Sc., Robotics Engineering *İzmir, Turkiye*

- Thesis: *Automating Farming Operations Using Robotic Technologies*- supervised by Assist.Prof.Dr. Fatih Cemal Can.
- Surveyed state-of-the-art agricultural robots: monitoring, spraying, harvesting, transport.
- Proposed a ROS ecosystem integrating Middleware, hardware, and software extensible with Edge IoT devices, to support developers and researchers in agricultural automation grasping tasks.

İzmir Kâtip Çelebi University Oct 2014 – Sep 2019

B.Sc., Mechatronics Engineering *İzmir, Turkiye*

- Thesis: *Development of a Multi-DOF Redundant Reconfigurable Planar Parallel Manipulator with 2-DOF Planar Detachable Serial Dyads*-supervised by Assist.Prof.Dr. Fatih Cemal Can
- Designed a redundant 6-motor / 3-DOF parallel manipulator with detachable serial arms, maximizing dexterous workspace within an 800 mm footprint
- Covered kinematics (direct/inverse), Ziegler-Nichols motor control tuning, vision-based obstacle avoidance, path generation, and platform locking mechanism
- Graduation project supported by TÜBİTAK 2209-A Bachelor Degree Programme (2019)

Peer-Reviewed Publications

[**1**] Al-Tawil, B., Jung, M., & Al-Hamadi, A. (2025). REMA-Net: A Lightweight Dual-Stream Attention Network for Real-Time Human Action Recognition in Robotics.
Elsevier – Under Review

[**2**] Al-Tawil, B., Jung, M., Hempel, T., & Al-Hamadi, A. (2026). SAR-SLAM: Semantic-Aware Recognition for Dynamic SLAM in Robotic Applications.
Robotics, 15(7), 136. doi:10.3390/robotics15070136 – Published

[**3**] Abdelrahman, A. A., Al-Tawil, B., & Al-Hamadi, A. (2026). Deep Learning-Based Gaze Estimation: A Review.
Robotics, 15(4), 69. doi:10.3390/robotics15040069 – Published

[**4**] Jung, M., Al-Tawil, B., Wachsmuth, S., & Al-Hamadi, A. (2025). Joint Estimation of Affective and Attentional States from Egocentric Video Input for Human-Robot Interaction.
Springer Nature – Under Review

[**5**] Al-Tawil, B., Jung, M., Hempel, T., & Al-Hamadi, A. (2025). Multi-Head Attention-Based Framework with

Residual Network for Human Action Recognition.
Sensors, 25(9), 2930. doi:10.3390/s25092930 – Published

[**6**] Jung, M., Abdelrahman, A., Hempel, T., Al-Tawil, B., Yang, Q., Wachsmuth, S., & Al-Hamadi, A. (2025). Eye Contact Based Engagement Prediction for Efficient Human–Robot Interaction.
Complex & Intelligent Systems, 11, 286. doi:10.1007/s40747-025-01902-z – Published, Open Access

[**7**] Jung, M., Hempel, T., Al-Tawil, B., Yang, Q., Wachsmuth, S., & Al-Hamadi, A. (2025). Toward Truly Intelligent Autonomous Systems: A Taxonomy of LLM Integration for Everyday Automation.
Robotics, Computer Vision and Intelligent Systems (ROBOVIS 2025), pp. 74–91. doi:10.1007/978-3-032-00986-9_6 – Published

[**8**] Al-Tawil, B., Candemir, A., Jung, M., & Al-Hamadi, A. (2025). Mobile Robot Navigation with Enhanced 2D Mapping and Multi-Sensor Fusion.
Sensors, 25(8), 2408. doi:10.3390/s25082408 – Published

[**9**] Al-Tawil, B., Hempel, T., Abdelrahman, A., & Al-Hamadi, A. (2024). A Review of Visual SLAM for Robotics: Evolution, Properties, and Future Applications.
Frontiers in Robotics and AI. doi:10.3389/frobt.2024.1347985 – Published

[**10**] Al-Tawil, B., et al. (2023). Design and Analysis of a Four DoF Robotic Arm with Two Grippers Used in Agricultural Operations.
International Journal of Applied Mathematics, Electronics and Computers (IJAMEC). doi:10.18100/ijamec.1217072 – Published

[**11**] Al-Tawil, B., et al. (2022). Automating Farming Operations using Robotics Technologies.
ICAT Conference, Pages 353–359 – Published

[**12**] Al-Tawil, B., et al. (2019). Development of a Multi Degrees of Freedom Redundant-Parallel Manipulator.
ISSC Conference, Pages 540–547 – Published

Ph.D. Research — Key Contributions

SAR-SLAM: Semantic-Aware Dynamic SLAM

- Plug-and-play module integrating YOLOv8-seg semantic detection and RANSAC homography geometric verification into ORB-SLAM3 without modifying the underlying codebase
- Achieved 96% ATE improvement on TUM RGB-D Dataset (0.404 m $\rightarrow$ 0.015 m); best or joint-best on all 8 evaluated benchmark sequences
- Three-stage adaptive fusion outperforms both pure semantic (DynaSLAM) and pure geometric (NGD-SLAM) baselines

REMA-Net: Lightweight Edge-Deployable Human Action Recognition

- Dual-stream network (RGB visual stream + BLIP semantic caption stream) with cross-modal knowledge distillation
- 96.8% accuracy on UCF-101, 73% on HMDB-51, 34.8% on HAA-500 — all at 200 FPS on desktop GPU
- 100 FPS on Jetson Nano (11.82 ms latency).

Enhanced Gmapping (EGM): Multi-Sensor Fusion for 2D Mapping

- Fused four RGB-D cameras (ASUS Astra) and dual LiDARs (Hokuyo UTM-30LX) via point-cloud-to-2D projection with adaptive particle resampling
- Reduced localization drift on mobile robots in indoor environments (0.85 m vs. 1.56 m baseline) with 95% goal success

Integrated Socially-Aware Navigation System STAC (Social Type-Aware Costmap): modular, robot-agnostic Nav2 costmap plugin generating dynamic, asymmetric Gaussian cost fields for proxemic compliance and socially acceptable approach behaviour; multi-modal perception backend (YOLO detection, pose estimation, human trajectory estimation) demonstrated on TIAGo with successful path deflection around human actors, deployable across heterogeneous platforms.

Academic & Research Experience

Otto-von-Guericke-Universität Magdeburg — NIT Lab Aug 2023 – Present
Ph.D. Researcher, Human-Robot Interaction Group *Magdeburg, Germany*

- Conducting dissertation research on mobile robot navigation in human-populated environments
- Designing, implementing, and validating deep learning methods for SLAM, HAR, and social navigation on PAL Robotics TIAGo

- Collaborating with Magnus Jung and Thorsten Hempel; publications across Frontiers, Sensors, and Springer

İzmir Kâtip Çelebi University — Robotics Engineering Feb 2020 – Feb 2023
M.Sc. Researcher *İzmir, Turkiye*

- Designed and validated a 4-DoF agricultural robotic arm with dual grippers; published in IJAMEC
- Founded iFarm startup; selected top 16 of 3,000+ projects at Climatelaunchpad (Holland, 2020)

Industry Experience

Electronics Company Apr 2022 – Jan 2023
Product Development Manager *Istanbul, Turkiye*

- Led development of three electronics products from concept to market-ready state; managed laboratory operations

iFarm Startup Jun 2020 – Jul 2022
Founder & Technical Developer *İzmir, Turkiye*

- Built and validated a full hydroponic automation system (Python, C, Arduino, custom hardware)

Lazer Market Nov 2019 – Feb 2020
R&D Engineer *İzmir, Turkiye*

- Developed tape-feeding machine integrated with CO2 laser cutter; designed HMI in Processing language

FabLab İzmir Municipality Apr 2019 – Oct 2019
Robotics Engineer *İzmir, Turkiye*

- Designed, manufactured, and programmed a 6-DoF robot arm and a CNC machine from scratch

Technical Skills

Robotics & Navigation	ROS / ROS 2 Humble, ORB-SLAM3, RTAB-Map, Gmapping, Nav2, MoveIt, Gazebo, RViz, Visual SLAM, Particle Filters
Deep Learning & AI	PyTorch, TensorFlow, YOLOv8, CLIP, BLIP, BERT, TinyLLaMA, MobileNetV3, ResNet, BiLSTM, Transformers, Knowledge Distillation, TensorRT
Programming	C++, Python, C, MATLAB
Hardware & Embedded	PAL Robotics TIAGo, Jetson Nano/Orin, Raspberry Pi, STM32, Arduino, ASUS Astra RGB-D, Hokuyo LiDAR
CAD & Simulation	SOLIDWORKS, MATLAB Simulink, Gazebo Classic
Languages	Arabic (native), English (advanced), Turkish (advanced), German (beginner)

Awards & Competitive Recognition

Accelerate2030 Turkiye (PEP — BMZ / GIZ / UNDP / Girvak / Impact Hub Istanbul) Turkiye, 2021
Selected as 1 of 15 (from 300+ applicants) for the world's largest impact-scaling programme — iFarm hydroponic automation system; included ministry visits and international mentoring

Accelerate İzmir — Growth Strategy Validation Programme, Teknopark İzmir (İzmir NIC) İzmir, 2022
Selected for coaching-based scale-up programme; assigned dedicated growth coach for commercialisation roadmap (CoMap) and barrier analysis (InnoBar) — iFarm hydroponic automation system

Climatelaunchpad International Competition Holland, 2020
Top 16 of 3,000+ global projects — iFarm hydroponic automation system

Bina Incubator Competition Istanbul, 2020
Top 8 of 300+ Turkish projects — iFarm hydroponic automation system

TÜBİTAK 2209-A Programme İzmir, 2019
National funding for undergraduate graduation project in robotics

Service & Leadership

President, Yemeni Student Union Association 2019
Elected by students across İzmir universities; resolved academic and social issues *İzmir, Turkiye*

Developer Engineer, COVID-19 Mechanical Ventilator Project 2020
Volunteer team designing open-source ventilation machine for patients *İzmir, Turkiye*

International Coordinator, İzmir Maker Fair 2018
Represented international companies at the annual maker exposition *İzmir, Turkiye*

References

Prof. Dr. Ayoub Al-Hamadi — Supervisor, Otto-von-Guericke-Universität Magdeburg, Neuro Information Technology. *Available upon request.*

Assist. Prof. Dr. Fatih Cemal Can — İzmir Kâtip Çelebi University, İzmir, Turkiye, Mechatronics Engineering Department. *Available upon request.*