Mohamed Al-Khulaqui

Website: https://alkrick.github.io/
Email: *mohamed_alk@outlook.com*
GitHub: https://github.com/Alkrick
Nationality: Yemen
Mobile: +86-13051478066
Linked-in: https://www.linkedin.com/in/alkrick/

Education

- **Beijing Institute of Technology** — Beijing, China
  M.S. *Mechanical Engineering; GPA: 3.6 .* — *Sep 2021 - Jul 2023*
  Thesis: Motion Planning Framework of Robotic Rat for Behavioral Interaction
  Notable Courses: Advanced Robotics, Design and Application of Robotic Systems, Micro-Nano Manufacturing and Mirco-Nano Robotic Technology

- **Beijing Institute of Technology** — Beijing, China
  B.S. *Mechatronics Engineering; GPA: 3.36 .* — *Sep 2017 - Jul 2021*
  Thesis: Plane Detection and Humanoid Robot Local Path Planning Based on Depth Vision.

Research & Work Experience

- **Legged Robot Motion Control R&D** — Beijing
  Xiaomi Technology Inc. Robotics Department — *Aug 2023 ∼ Current*
  - **Blind Locomotion**: (Individual)
    Developed a Concurrent Teacher-Student training framework for legged robot blind locomotion using Implicit-Explicit Estimation. Design of training environment, Implementation of the concurrent teacher-student algorithm, reward optimization and tuning, hardware deployment.
  - **Quadruped Parkour**: (Individual)
    Utilized a two-stage Teacher-Student DRL framework for vision-based legged robot parkour. Design of training environment, reward optimization and tuning, deployed on quadruped, achieved agile environment traversal, climbs on platforms of approximately 1.5 times body height
  - **MPC-Based Skateboarding**: (Group)
    Aided in developing an MPC model for quadrupedal robot skateboarding. Trajectory data collection, experiments & analysis, published on ICRA 2024. [3]

- **Student Researcher**
  Beijing Advanced Innovation Center for Intelligent Robots and Systems (BAICIRS) — *3 years*
  - **Motion Planning Framework of Robotic Rat for Behavioral Interaction**:
    Master Thesis (Individual): Developed a motion re-targeting method for rat-robot mapping, modeled rat behaviors using ProMPs and implemented rat tracking through visual servoing.
  - **Real-Time Rat Pose Estimation**: (Group)
    Aided in developing a real-time lab rat pose estimation model. [1]
  - **Imitation Learning for Motion Generation**: (Group)
    Aided in developing an IL algorithm for Rat-like motion generation. [2]
  - **Footstep Planning for Humanoid Robot based on Depth Vision**: (Individual)
    Developed a depth vision local path planning algorithm for the team's humanoid robot BHR-2. Organized into bachelor thesis which received "outstanding" grade.

Technical Skills

- **Robot Motion Planning**: Experienced with various motion planning algorithms, probabilistic methods and non-linear optimization as well as hardware implementations using C++ and ROS.
- **Control of Robotic Systems**: Kinematic and Dynamic modeling, Trajectory Optimization, Model Predictive Control.
- **Vision & Sensors**: RGB-D Cameras, IMUs, Image processing (OpenCV), Point cloud processing (PCL).
- **Machine Learning**: PyTorch, Deep Reinforcement Learning (PPO), Imitation Learning, Object Detection & Recognition (YOLO)

Computer Skills

- **Programming**: C/C++, CMake, MATLAB, Python, OpenCV, Linux, ROS, Qt, LaTeX, Git, Bash.
- **Simulation**: Isaac Sim/Lab/Gym, MuJoCo, Simulink, Gazebo.
- **3D Modeling & CAD**: Solidworks, AutoCAD, Blender.
- **Embedded Development**: Experienced with C and C51 development of micro-controller applications (STM32, Arduino).

Publications

[1] X. Guo, G. Jia, **M. Al-Khulaqui**, Z. Chen, T. Fukuda, and Q. Shi. Real-time pose estimation of rats based on stereo vision embedded in a robotic rat. In *2023 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pages 4690–4695, 2023. DOI: 10.1109/IROS55552.2023.10342475.

[2] H. Xie, G. Jia, **M. Al-Khulaqui**, Z. Gao, X. Guo, T. Fukuda, and Q. Shi. A motion generation strategy of robotic rat using imitation learning for behavioral interaction. *IEEE Robotics and Automation Letters*, 7(3):7351–7358, 2022. DOI: 10.1109/LRA.2022.3182472.

[3] Z. Xu, **M. Al-Khulaqui**, H. Ma, J. Wang, Q. Xin, Y. You, M. Zhou, D. Xiang, and S. Zhang. Optimization based dynamic skateboarding of quadrupedal robot. In *Proceedings of the IEEE International Conference on Robotics and Automation (ICRA)*, 2024. (Accepted).

Languages

- **English**: Fluent, IELTS 8.0.
- **German**: Intermediate, Goethe B1.
- **Chinese**: Fluent
- **Arabic**: Fluent, Mother Language.
- **Japanese**: Basic