MUHAMMAD LABIYB AFAKH

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SUMMARY

Robotics Engineer and PhD Candidate with 8+ years developing robot systems including autonomous capability using C, C++ and Python. Specialized in system integration, real-time control (PID and Fuzzy) and navigation algorithms with experience in ROS-based autonomous platforms.

- Experience in autonomous navigation systems with several sensor (IMU, LiDAR, cameras), collision avoidance, and path tracking across aerial, mobile, and water surface robotic platforms
- Full-stack robotics development capability: building complete autonomous systems from scratch including mechanical design and manufacturing, electrical hardware development, embedded or low-level programming, system integration, and intelligence on high level.
- Strong embedded systems background with extensive hardware debugging experience including serial communication protocols, socket programming and sensor interface troubleshooting
- Achieved 500Hz real-time performance in multi-sensor data processing and control systems

PROFESSIONAL EXPERIENCES

Computer Vision and Robot Motion October 2025-now
FingerVision,Inc. (Intern)

- Build the system and robot motion for UR3 utilizing visual information from FingerVision sensors.
- Collect and annotate dataset for fine-tuning.

Robotics Engineer April 2024 - March 2025
QibiTech Inc. (Part-Time)

- Developed ROS2 packages for HR4C manipulator with MoveIt integration, implementing hardware interfaces supporting position, velocity, and effort control modes, along with action servers and test suite.
- Developed robot description (URDF), visualization, and simulation on pybullet/gazebo.
- Improved the system integration between Kachaka AMR and HATS.
- Investigated the manipulability and navigation of a mobile manipulator robot using Gazebo and Robotics Toolbox Python simulation.

Research and Development Engineer Jan 2022 - March 2024
Shanghai Micro Ears Ingeniousness Intelligent Technology Co., Ltd. (Part-Time)

- Designed and manufactured the robot structure.
- Developed the software for the embedded system.
- Optimized serial communication and visualized the data on Graphical User Interface (GUI) in 200Hz sampling rate.
- Developed and integrated system with a manipulator robot (myCobot 320).

Freelance Robotics and Embedded System Engineer 2018-2019

- Built an embedded system for solar tracker to move the solar panel by given position that sent from base-station.
- Built a small-device for weighing system used in a gas company.
- Built embedded system for pull and press machine including monitoring of the pressure.

SKILLS

Programming	C++ (primary), Python, C
Autonomous Systems	ROS1/ROS2, SLAM, Navigation Algorithms, Sensor Fusion, Path Tracking, Obstacle Avoidance
Real-time Systems	Embedded Systems, Serial Communication, Control Systems, PID/Fuzzy Controllers
Computer Vision	OpenCV, Object Detection, Visual Servoing, PyTorch
Simulation & Tools	Gazebo, MuJoCo, PyBullet, Git, CI/CD, CAD, CAM, Docker
Hardware	ARM-based(STM32 and NXP(Teensy)), ESP32, IMU, MID360
Robot Platforms	UR3, Kachaka Pro, Seed-Noid-Mover, HR4C, myCobot 320
Languages	Indonesian (Native), English (Fluent), Japanese (Beginner)

EDUCATION

Doctor of Mechanical Systems Engineering, Tokyo Metropolitan University — Mar 2026 (Expected)
Master of Mechanical Systems Engineering, Tokyo Metropolitan University — Oct 2019 - Sept 2021

- Relevant Courses: Robotic System Design, Intelligent Robot, Ubiquitous Robotics

Bachelor of Computer Engineering, Electronics Engineering Polytechnic Institute of Surabaya — 2014 - 2018

- Relevant Courses: Embedded System, Robot System & Control, Computer Vision, Intelligent System, Robotic and Automation, and Real-Time Operating System

HONOR AND MEMBERSHIP

- Institute of Electrical and Electronics Engineers (IEEE) Society (current)
- IEEE Robotics and Automation Society Membership (current)
- The Japan Society of Mechanical Engineers (current)
- Second Runner-up Customer Interaction Task Category, World Robot Summit FCSC @IFAC 2023
- Runner Up Toilet Cleaning Robot Category, World Robot Summit FSCS Trial Competition 2019
- Second Runner Up of ABU Robocon 2016 2016
- Winner ABU Robocon Indonesia Contest 2016

ACADEMIC EXPERIENCES

Research Assistant (Part-Time) — Jan 2025 - Present
Tokyo Metropolitan University — *Japan*

Tokyo Metropolitan University Arena Reframing (AR) Research Fellow — Apr 2023 - Sept 2024
Tokyo Metropolitan University — *Japan*

Research Assistant (Part-Time) — Oct 2021 - Mar 2023
Tokyo Metropolitan University — *Japan*

Student Intern — Jan 2017 - Feb 2017
BRIN-Aviation and Space Research Organization — *Indonesia*

PUBLICATIONS

Journals

- **Study Towards a Flapping Robot Maintaining Attitude During Gliding.** International Journal on Advance Science, Engineering, Information, and Technology (IJASEIT) · Jan 22, 2023

- **Performance Evaluation and Wing Deformation Analysis of Flapping-Wing Aerial Vehicles with Varying Flapping Parameters and Patterns**, Journal of Robotics and Mechatronics, Vol.36, No.5, 2024/10.

Conferences

- **Servo-Driven Flapping Robot That Uses Its Tail for Self-Standing Takeoff**. 2025 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2025). **(Presented, Co-author)**
- **Servo-Driven Flapping-Wing Aerial Vehicle (FWAV) Payload Capacity and Navigation Performance.**The 2025 IEEE/SICE International Symposium on System Integration (SII).
- **Development of Flapping Robot with Self-Takeoff from The Ground Capability.** IEEE International Conference on Robotics and Automation (ICRA) · Oct 18, 2021
- **Bicycle Path Planning on Omnidirectional Mobile Robot Using Fuzzy Logic Controller.** IEEE · Aug 7, 2018
- **Implementation of PID Controller in Active Ball Handling System of Middle Size Robot Soccer.** IEEE · Aug 7, 2018
- **Aksara Jawa Text Detection in Scene Images using Convolutional Neural Network.** IEEE · Sep 27, 2017

PROJECTS

Six-leg Robot Locomotion. January 2025 - Present
Contribution:

- Implementing RL algorithms in MuJoCo simulation environment.

Ornibibot, an agile flapping micro aerial vehicle (FMAVs). Oct 2019 - Present.
This project develops an ornithopter that can be a helpful robot for future in the society. This project is a part of my academic path from master student to PhD student (current).

Contribution:

- Developed several robot's mechanical structure including design and manufacture.
- Developed robot's hardware utilizing several kinds of micro-controller (ARM based and ESP32) and single board computer (ARM based).
- Developed robot's low-level and high-level system and controller with or without ROS1/ROS2.
- Implemented PID controller with given Inertial Measurement data to perform attitude control using tail mechanism.
- Improved the performance serial communication by optimizing the packet data so it could work in above 500Hz.
- Conducted comprehensive system analysis by integrating force sensors and motion capture cameras to measure wing deformation and thrust generation.
- Improved system capabilities through mechanical optimization achieving 100g payload capacity, while implementing on board collision avoidance utilizing 8x8 ToF and 50Hz UDP communication with base station.
- Currently working on enhancement collision avoidance performance by changing the visual information from 8x8 ToF to get better visual information. Also, simulate the visual information and navigation using MuJoCo.

- Skills: C, C++ (ROS1/ROS2), Python, CAD, CAM, EDA, MuJoCo, Computer Vision
- Repositories:

- https://github.com/labiybafakh/OrnibiBot
- https://github.com/labiybafakh/OrnibiBotMicro
- https://github.com/labiybafakh/OrnibiBotObstacleAvoidance

Unmanned Water Surface Vehicle (January - March 2025)
Developed autonomous water surface vehicle with advanced navigation and control systems, focusing on ROS2 migration and comprehensive system architecture design. Key Achievements:

- Migrated legacy ROS1 codebase to ROS2 for improved real-time performance and distributed system capabilities
- Debugged and optimized code and system for reliable autonomous operation (navigation and SLAM).

Skills: C++, ROS2

Autonomous Service Robot with SLAM (May - July 2023)
Led development of autonomous service robot for retail environment using manipulator, SLAM and computer vision.

Key Achievements:

- Led programming team for World Robot Summit competition (2nd runner-up)
- Integrated multiple subsystems: manipulator pick and place, LiDAR SLAM, Kinect vision, and navigation stack
- Implemented autonomous navigation with obstacle avoidance in dynamic environments
- Developed computer vision system for object recognition and grasping position estimation

Skills: Python, ROS, MoveIt, PyTorch, SLAM, Computer Vision
Repository: WRS2023

Autonomous Mobile Robot Navigation System - Bachelor Thesis (2017-2018)
Developed advanced navigation system for omnidirectional robot soccer platform with autonomous path recovery capabilities after collision or obstacle interference.

Project Overview: This bachelor thesis project addressed the challenge of navigation recovery when robots collide with obstacles or other robots during autonomous operation. The system was validated through V-REP simulation environment by implementing bicycle path tracking algorithms.

Key Achievements:

- Implemented bicycle path tracking algorithm with fuzzy logic controller that dynamically adjusts look-ahead distance and robot velocity, significantly reducing overshoot during path recovery
- Developed real-time PID controllers for precise individual motor speed control and robot orientation
- Integrated wheel odometry and IMU data for accurate position estimation and localization
- Successfully demonstrated smooth path recovery after external force disturbances, with robot automatically returning to desired trajectory
- Implemented robust ROS-based communication architecture for data distribution between low-level and high-level control systems
- Validated system performance through simulation testing where external forces were applied to knock robot off-path, demonstrating autonomous recovery capabilities

Skills: C/C++, STM32, Embedded Systems, ROS, PID/Fuzzy Controllers, Qt, V-REP Simulation
Repository: FuzzyBicyclePathTracking

Unmanned Fast Boat PENShip. Oct 2016 - Dec 2016.
Built autonomous water surface vehicles with visual servoing navigation system, successfully demonstrating path-following capabilities in competitive environment.

- Implemented visual servoing for autonomous path following using camera feedback
- Developed color-based object detection and tracking algorithms
- Successfully navigated catamaran and monohull vehicles in USV Contest 2016

- Led team coordination and system integration efforts

Skills: C/C++, Computer Vision (OpenCV), Embedded Systems

ABU Robocon 2016

Key Achievements:

- Developed embedded control systems for coordinated two-robot autonomous operation
- Implemented navigation algorithms using odometry feedback for precise robot positioning and guidance
- Integrated multiple feedback sensors (IMU, encoders, proximity sensors) for robust system operation
- Achieved significant performance improvements through iterative optimization: 36 seconds (regional), 23 seconds (national), and 18 seconds (international competition)
- Successfully demonstrated non-contact robot guidance, autonomous object manipulation, and climbing capabilities
- Led system integration, testing, and performance optimization achieving 70% improvement over previous competition results
- Won ABU Robocon Indonesia Contest 2016 and achieved 2nd Runner-up in international competition

Skills: C, STM32, Embedded Systems, Autonomous Navigation, Sensor Integration