MUHAMMAD LABIYB AFAKH

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SUMMARY

I am a last-year PhD Student and FS-SPRING Research Fellow. Enthusiastically engage in building and programming custom robotics projects, enhancing hands-on skills in software integration. I am motivated to utilize my expertise in Embedded Systems, Robotics, and Mechatronics to solve real-world problem to enhance the society.

- Experience in developing mechanical, hardware, and software of a robot from scratch.
- Experience in C/C++/Python to build some Embedded/Robot System and data processing.
- Experience in integrating systems with and without the use of the Robotics Operating System (ROS1/ROS2).

PROFESSIONAL EXPERIENCES

Research and Development Engineer Jan 2022 - Oct 2023
Shanghai Micro Ears Ingeniousness Intelligent Technology Co., Ltd. (Part-Time)

- Design and manufacture the robot structure.
- Build the software for the embedded system.
- Optimize the serial communication and visualize the data on Graphical User Interface(GUI) in 200Hz sampling rate.

Freelance Robotics and Embedded System Engineer 2018-2019

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

SKILLS

Technical Skills C, C++, Python, Rust, ROS1/ROS2, CI(Github Actions), CAD, CAM, EDA.
Languages Indonesian(Fluent), English(Fluent), Japanese(Beginner).

EDUCATION

Doctor of Mechanical Systems Engineering, Tokyo Metropolitan University Oct'2021 - Sept'2024(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

- IEEE & Robotics and Automation Society Membership now
- 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 Fellow now
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

Conferences

- **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

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(now).

- I built this robot from scratch. I also designed and manufactured the mechanism and electrical circuit board. I also built the embedded system and GUI/visualization.
- The previous version robot used ROS 1 as the data distribution system framework. A Wireless connectivity was chosen to enable long-distance control. A Raspberry Pi-Zero was used to handle the communication with the base station and low-level controller . An Arduino Nano 33 BLE which is a low-level controller was used to support the system and control the attitude of robot by using PID controller. Those master and slave hardware are connected via serial communication.
- The current version uses ROS2. A teensy 4.1 which is a powerful ARM microcontroller was used to support the data acquisition. The collected data from teensy is sent to the PC using created serial communication protocol in a low-latency. There is a node to handle the data to be integrated with another ROS2 sub-system or IPC through shared-memory.
- Technical Skill: C, C++(ROS1/ROS2), Python(Data Processing), CAM, CAM, EDA
- Repository for High-Level(Desktop): https://github.com/labiybafakh/OrnibiBot
- Repository of low-level(Microcontroller):https://github.com/labiybafakh/OrnibiBotMicro

Customer Interaction Service Robot. May - July 2023. This project aims to handle some problems that can happen at the convenience store such as a large queue size and object returned to its shelf. This project is a part of WRS competition held during IFAC2023. A Seed R7 which is a service mobile robot platform is used to handle the

tasks. In our system, we were trying to offer self-payment and returning the cancelled products. A kinect camera is mounted to estimate the grasping position and type of the object that will be returned to its shelf. To monitor the queue, another camera is also placed on the environment. A lidar is also mounted to the robot for simultaneous localization and mapping(SLAM). It is used for robot to navigate to the desired position and avoid the obstacle. The data distribution is handled by using ROS.

- I was the person in charge to develop, integrate and optimize the system.
- I integrated some sub-systems and evaluated the robot navigation and manipulation to perform the desired states or actions.
- Technical Skills: Python(ROS)
- Project's repository: https://github.com/labiybafakh/WRS2023

Navigation of Omnidirectional Mobile Robot(Robot Soccer). 2017-2018. This bachelor thesis project is triggered by an idea to recover a navigation when there is an obstacle or hits another robot. A robot simulation(V-REP) was used to simulate the robot locomotion to implement bicycle path tracking. **PID controller** are used to control the speed of each motor on its low-level hardware and to control the robot orientation. **A fuzzy logic controller** is used to change or improve some parameters during navigating such as look-ahead of robot during performing path tracking and velocity of the robot. By using a given path and gave a force to the robot, the robot was succeeded to back to its right path smoothly. The performance is better after the fuzzy was implemented because it can reduce the overshoot. **Robotics Operating System(ROS)** utilize the robustness of system through the data distribution.

- Repository: https://github.com/labiybafakh/FuzzyBicyclePathTracking
- Technical Skills: C, C++(ROS1)

Unmanned Fast Boat PENShip. Oct 2016 - Dec 2016. This project worked with an unmanned water vehicle to complete a task. I became the head of this project to manage or to organize the team working as the desired. It participated in Unmanned Surface Vehicle(USV) Contest 2016. We built catamaran and monohull boats using balsa wood. The USVs navigate autonomously using a feedback information from a camera. It used a basic concept of computer vision to detect the color and calculate theta of colored balls. There are color-coded balls arranged on the edges of the path. These balls serve as boundary markers for autonomous navigation using cameras. By using the visual servoing, the robot can navigate to stay on the track.

- I was given the responsibility to handle the software and became the team leader.
- Optimize the performance of system to handle visual servoing or navigation.
- Technical Skills: C and C++

ABU Robocon 2016 In this project, I and my team were trying to build mobile robot to handle or to solve the tasks. We built 2 autonomous robot with different size, the small robot could not move by itself and has only a steering mechanism. Several iteration of robot development from scratch were done.The bigger robot has to drive the small robot without making contact. After the robot is succeeded to drive the small robot, the bigger robot should pick the propeller that is mounted on small robot, climb a pole, and place the propeller on the pole.

- I was given the responsibility to handle the embedded systems from scratch and do navigation.
- Navigation was built using odometry data from sensor fusion between rotary encoder and Inertial Measurement Unit(IMU).
- Technical Skills: C

LEADERSHIP

- Chairman of PPI (Persatuan Pelajar Indonesia/Indonesian Student's Association) Tokyo Metropolitan University, Japan. Apr 2020 - Apr 2021