

QUANG-HA PHAM

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RESEARCH INTERESTS

Robotics, Signal Processing, Control Theory and Embedded Systems.

EDUCATION

- M.Eng.** University of Technology, VNUHCM Mar 2021 – present
- **Major:** Control Engineering & Automation (*Research Program*)
 - **GPA:** 8.85/10.0
 - **Thesis:** Simultaneous Localization and Mapping based on Camera-LiDAR Fusion in Riverine Environments (*defended with 9.3/10.0*)
- B.Eng.** University of Technology, VNUHCM Sep 2016 – Nov 2020
- **Major:** Control Engineering & Automation (*Honors Program*)
 - **GPA:** 8.42/10.0
 - **Thesis:** Constructing Map and Collision-Free Path for Autonomous Vehicles (*defended with 9.58/10.0*)

RESEARCH EXPERIENCE

- Graduate Research Assistant** Oct 2020 – present
VIAM Lab, University of Technology, VNUHCM
- Develop a direct SLAM based on camera-LiDAR fusion:
 - Propose an improved image alignment algorithm, a fast cloud registration algorithm and a factor-graph-based windowed optimization algorithm.
 - Utilize ikd-Tree data structure for map management.
 - Implement by object-oriented programming style in C++ and use ROS's ecosystem for visualization.
 - Extensively evaluate the system's performance on various riverine and non-riverine environments.
 - Build a ROS2-based version of VIAM-USV-VC autopilot software suite.
 - Build a ROS-based autopilot software suite, namely VIAM-USV-VC, for VIAM-USV2000 surface vessel:
 - Implement previously simulated WAM-V's algorithms.
 - Realize data interchange with STM32F407 microcontroller through CAN bus, with VIAM-USV-GC ground control station through MAVLink protocol.
 - Deploy in Jetson Nano embedded computer.
 - Simulate some autonomous capabilities for surface vessel on Gazebo:
 - Refine 3D model of WAM-V surface vessel by equipping it with additional sensors and actuators.
 - Implement R-modelled sliding-mode heading controller, straight-or-bspline LOS path following, SBG obstacle avoidance.

- Build a customized version of QGroundControl ground control station, namely VIAM-USV-GC, for VIAM-USV2000 surface vessel.

Research Assistant

Jul 2018 – Oct 2020

VIAM Lab, University of Technology, VNUHCM

- Develop an online, graph-based LiDAR SLAM:
 - Implement PLICP fast scan-matcher for dense pose graph construction.
 - Perform sliding-windowed optimization on graph's nodes by g2o.
 - Utilize ROS's ecosystem to facilitate sensor reading, data interchange, data logging and algorithmic visualization.
 - Test the system's performance prior to real-world deployment by simulating on Gazebo.
 - Carry out experiments with Hokuyo UTM-30LX 2D LiDAR in both structured and natural environments.
- Build a Qt-based GUI to remotely command and monitor Delivery AGV:
 - Utilize MAVSDK to establish connection and realize data interchange with the vehicle's autopilot.
 - Realize data interchange with Android-based ordering application through MQTT protocol.
- Build a ROS-based autopilot software suite for Delivery AGV:
 - Implement straight LOS path following, PID heading control.
 - Realize data interchange with STM32F407 microcontroller through UART bus, with monitor GUI through MAVLink protocol.
 - Deploy in Raspberry Pi 4 embedded computer.

PUBLICATIONS

2022

Q.-H. Pham, N.-H. Tran and T.-D. Nguyen, "IMU-Assisted Direct Visual-Laser Odometry in Challenging Outdoor Environments," in *2022 6th International Conference on Green Technology and Sustainable Development (GTSD)*, Nha Trang City, 2022 (accepted).

2021

N.-H. Tran, **Q.-H. Pham**, J.-H. Lee and H.-S. Choi, "VIAM-USV2000: An Unmanned Surface Vessel with Novel Autonomous Capabilities in Confined Riverine Environments," *Machines*, vol. 9, no. 7, p. 133, 2021.

Q.-H. Pham, N.-H. Tran, T.-T. Nguyen and T.-P. Tran, "Online Robust Sliding-Windowed LiDAR SLAM in Natural Environments," in *2021 International Symposium on Electrical and Electronics Engineering (ISEE)*, Ho Chi Minh City, 2021.

2020

N.-H. Tran, M.-H. Vu, T.-C. Nguyen, M.-T. Phan and **Q.-H. Pham**, "Implementation and Enhancement of Set-Based Guidance by Velocity Obstacle along with LiDAR for Unmanned Surface Vehicles," in *2020 5th International Conference on Green Technology and Sustainable Development (GTSD)*, Ho Chi Minh City, 2020.

PROJECTS

Design and Control a Delivery AGV

Sep 2019 – Sep 2020

2019 Scientific Research for Student, funded by Faculty of Electrical & Electronics Engineering, University of Technology, VNUHCM

- **Role:** I was responsible for building the autopilot software suite on embedded computer, implementing guidance and control laws, designing monitor GUI on laptop.
- **Description:** We aim to make local delivery faster and cheaper without human intervention by designing an automated guided vehicle. Our team managed to design the electrical components of Delivery AGV, build ordering mobile application for buyers and monitor GUI for shop-owners, as well as automate the vehicle's journey.
- **Result:** Our project earned an acceptance certificate at the end of the program.

HONORS AND AWARDS

Certificate of Merit

Jan 2021

For outstanding research achievements in research competitions during 2019 – 2020 academic year, signed by Principal of University of Technology, VNUHCM.

City Excellent Student

April 2016

Second prize of the Excellent Student in English, organized by the Department of Education Training, Ho Chi Minh City, Vietnam.

SKILLS

Maths: Linear Algebra, Probability, Differential Equation, Vector Calculus, Calculus of Variations, Fourier Analysis, Numerical Analysis, Complex Analysis, Differential Geometry.

Language: C/ C++, MATLAB, Python.

Framework: ROS, ROS2, Gazebo, MATLAB/Simulink, Qt, g2o, MAVSDK.