Project Title: Autonomous Drone Swarm for Drug Delivery in Covid-19 Pandemic

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Introduction

Background:

Three possible use cases of drones in COVID-19 pandemic include 1) delivery and transportation of medical supplies in order to reduce the transportation times and minimize the exposure to infection, 2) aerial spraying of public areas in order to disinfect potentially contaminated places, and 3) public space monitoring and guidance during lockdown and quarantine. However, it is underestimated for its capability to enhance the navigation accuracy as well as delivery schedule.

Targets:

- Propose solutions for autonomous drone swarm for smart delivery including: 1) autonomous navigation using computer vision and deep learning; 2) delivery schedule optimization with targeting in minimizing transportation time, energy and payload using machine learning and deep learning assistants.
- Contribute to capacity building of ASEAN institutions in the field of drone technology.
- Develop existing links and establish new links for researchers from ASEAN, Korea, Japan and EU in the areas of drone technology. This is attainable through interaction mechanisms during our capacity building sessions.
- Deliver both international leading-edge research and uniquely skilled researchers in the area of AI powered efficient and autonomous drone swarm for delivery.

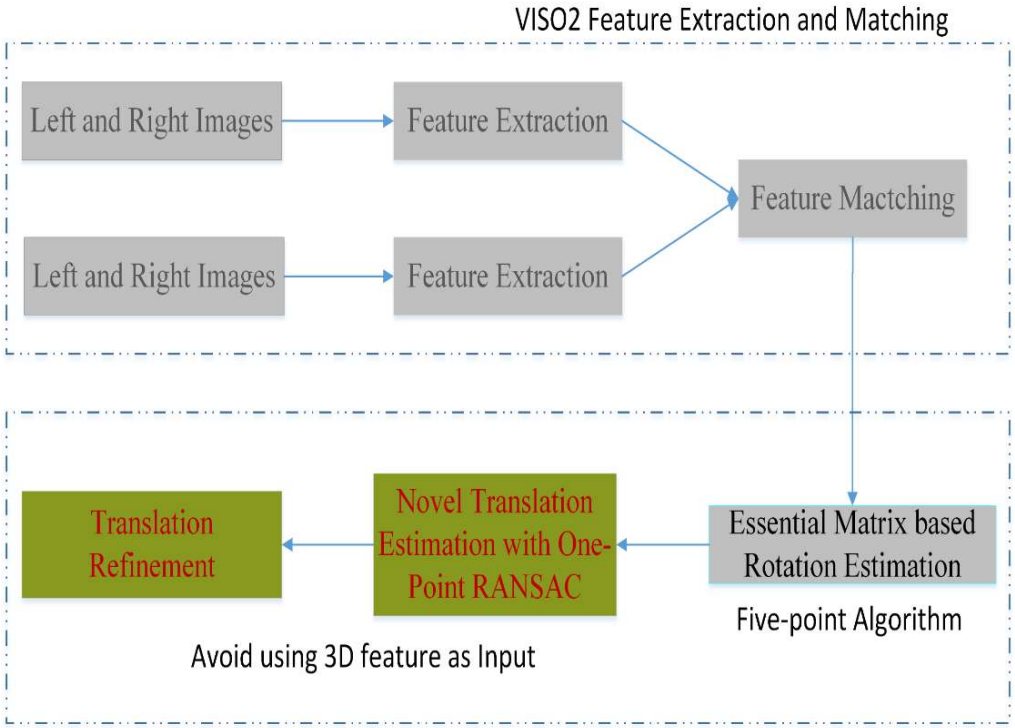
Project leader: Dr. Huu-Hung Nguyen (LQDTU, Vietnam)

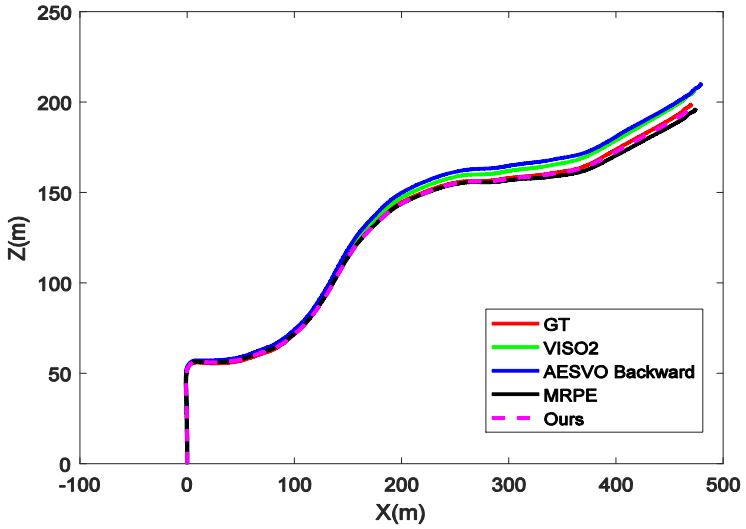
Autonomous drone for safe food and medicine delivery

Require Safe-Smart Delivery

- In Covid 19 pandemic, a safe delivery service for food and medicine is necessary.
- The development of Artificial Intelligence (AI) provides efficient tools for smart navigation and path schedule.

Some Preliminary Results





Section 03, KITTI Dataset

- Closed-form translation estimation from 2D features directly, not using 3D features due to the 3D uncertainty.
- Rotation extracted from essential matrix estimation avoids the left-right calibration.

H. -H. Nguyen, T. -T. Nguyen, C. -M. Tran, K. -P. Phung and Q. -T. Nguyen, "A novel translation estimation for essential matrix based stereo visual odometry," IMCOM2021.

Intellectual Merit of Proposed Project

- This project will provide basic guidelines on drone technologies, computer vision, deep learning approaches for autonomous drone navigation, path planning, and its related technologies.
- The results will be presented and published in renowned and impactful conferences and journal papers to share our idea, developed technologies to show the technical benefits.
- We will focus on developing the standardization activities under this collaboration to ensure international sustainability and expandability.
- We also will apply for patents and collaborate with industry to transfer our technology to society for practical applications.

Methods

- Based on a deep and comprehensive survey on the autonomous drone swarm and current research issues of delivery-based drones, existing solutions in this topic, we will clarify the detailed requirements for implementing a smart delivery based on efficient drone swarm.
- Based on assessing the limitations of existing solutions, the research team will propose innovative and new solutions to improve the autonomous navigation for drone and optimal delivery schedule based on multiple objective techniques.
- An efficient drone navigation is proposed using multimodal deep learning on data captured from multiple sensors.
- A multiple-objective optimization approach will be developed to obtain an optimal delivery schedule for all drones.

Proposed Content

- **WP (Work package 1)**: Management and logistics.
- **WP2**: Deep and comprehensive survey and current research issues, and existing solutions in this topic (drone swarm, autonomous navigation for drone, multiple objective schedule optimization).
- **WP3**: Prototype development and proof-of-concept experiment.
- **WP4**: Demonstration, application development and technology transfer

Plan for Connected Projects

- Collaboration between different partners to share the knowledge and experience in this emerging and exciting field;
- Promote the developed technologies to academia, industry, and practical applications in different countries:
  - Dr. Huu-Hung Nguyen, Prof. Van-Phuc Hoang, Dr. Van-Trung Nguyen and others from LQDTU, Vietnam.
  - Dr. The-Thien Huynh, Kumoh National Institute of Technology, Korea.
  - Dr. Van-Sang Doan, Vietnam Naval Academy, Vietnam
  - Prof. Van-Phuc Nguyen, University of Texas at Arlington, USA.

Conclusions

- Smart delivery is essential task for delivering food and medicine, especially in Covid 19 pandemic.
- The development of Artificial Intelligence (AI) provides efficient methodologies for autonomous navigation of drone as well as path scheduling.
- The proposal will be performed with collaboration of leading experts from ASEAN countries, Korea, and USA.