2025 EECMS Summer Internship Application Form

Main Supervisor	Hoa Van Nguyen
Other supervisors (if applicable)	Tran Thien Dat Nguyen; Changbeom Shim; Ba-Tuong Vo; Ba-Ngu Vo
Project Title	Autonomous Aerial Surveillance: Enhancing Security Through Embedded Drone Systems
Student location(s) for the project	Intelligent Sensing & Perception Laboratory (ISPL) – Level 4 – B314 – Bentley Campus – Curtin University
Duration of project	Eight weeks
Project Description	In recent years, *unmanned aerial vehicles (UAVs*), commonly known as drones, have emerged as a transformative technology with diverse applications across various sectors. One of the most promising areas for drone utilisation is in the field of surveillance, particularly for defence and security purposes. This project aims to develop a cutting-edge, autonomous video surveillance system using aerial drones equipped with advanced imaging technologies. The rapid advancement of drone technology, coupled with improvements in computer vision and embedded systems, has opened up new possibilities for enhancing surveillance capabilities. Traditional ground-based surveillance systems often face limitations in coverage area, mobility, and adaptability to changing environments. Aerial surveillance via drones offers a solution to these challenges by providing a dynamic, bird's-eye view of target areas, enabling more comprehensive and efficient monitoring. Our proposed system will utilise drones with both thermal and visual cameras, enhancing the ability to detect and track objects of interest in various lighting conditions. The project may encompass four key tasks: 1. **Object Detection and Tracking:** We will explore different advanced algorithms for real-time object detection and tracking from aerial video feeds, using state-of-the-art computer vision techniques, including deep learning models optimized for aerial imagery. 2. **2D to 3D Calibration:** We will apply algorithms to map 2D image data back to 3D world coordinates, accounting for factors such as drone altitude and camera orientation, enabling precise location information of detected objects. 3. **Embedded System Implementation:** We will implement our tracking and analysis algorithms on *the NVIDIA Jetson Orin* platform, enabling on-board processing of video feeds and autonomous decision-making by the drone system. 4. **Performance Validation:** Rigorous testing and validation will be conducted to ensure the system's reliability, accuracy, and efficiency in various real-world scenarios. During the 8-week timeframe, the project will primarily concentrate on the first **two tasks**. Depending on the progress made, we may extend it to the remaining tasks if time allows. The successful implementation of this project will have far-reaching implications for security and surveillance operations, enhancing situational awareness, reducing response times, and improving overall security effectiveness. The applications of this technology extend beyond traditional security contexts, with potential use in search and rescue, wildlife monitoring, and disaster response. This project is an opportunity for the student to learn about the current advancements in signal processing and computer vision, as well as gain hands-on experience that would be beneficial for their future engineering career.