TECHNOMART Malaysia - Navigating The Future Through Drone-Related Technologies

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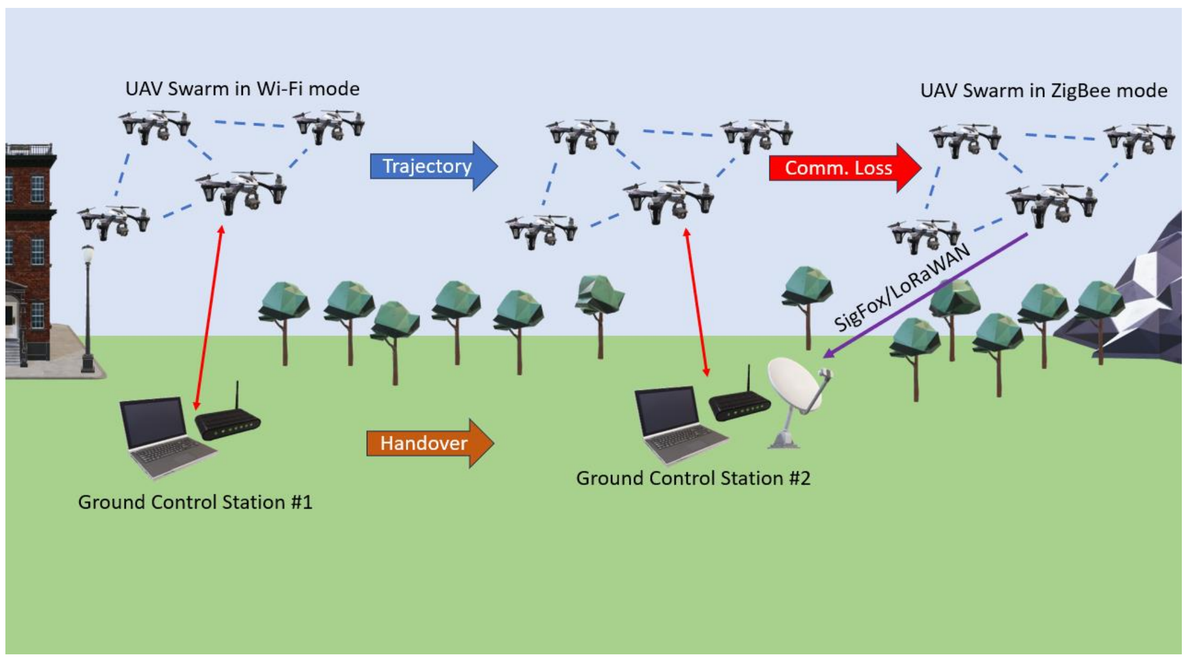
Reliable Communication Architecture for Navigation and Guidance of Interconnected Aerial Vehicles

INTRODUCTION

Decentralized UAV swarm networks can enable numerous innovative multi-UAV applications, but their reliability and performance are degraded by the high mobility of the UAVs. This project proposes a novel communication architecture for UAV swarms with improved network performance, utilizing various wireless technologies such as Wi-Fi, ZigBee, SigFox, and LoRaWAN. Each layer of the architecture is further improved to ensure data can be communicated reliably and allow seamless deployment of cost-effective multi-UAV solutions across various industries.

IMPLEMENTATION OF UAV SWARM NETWORK



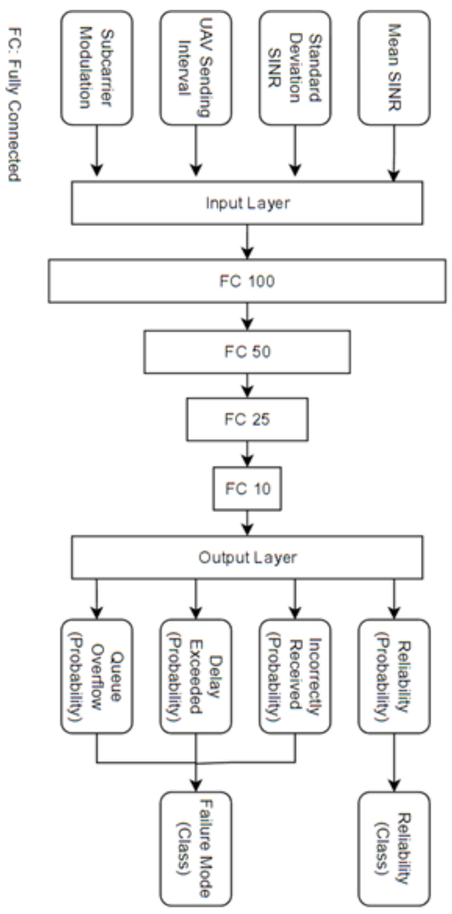
Aspects of the communication system associated with each wireless technology are enhanced for UAV swarm networks:

Wi-Fi:

- A multi-layer communication framework using AI is designed to improve the overall bandwidth of UAV-to-UAV links.
- A machine learning framework to predict and maintain the reliability of UAV-to-Infrastructure links is developed.
- A smart handover system with mobility management is proposed to reduce unnecessary handovers.

ZigBee: An inter-network handover system is developed to automatically switch Wi-Fi to ZigBee when power is low.

SigFox and LoRaWAN: A system to detect communication losses and broadcast emergency packets to the Ground Control Station is developed.

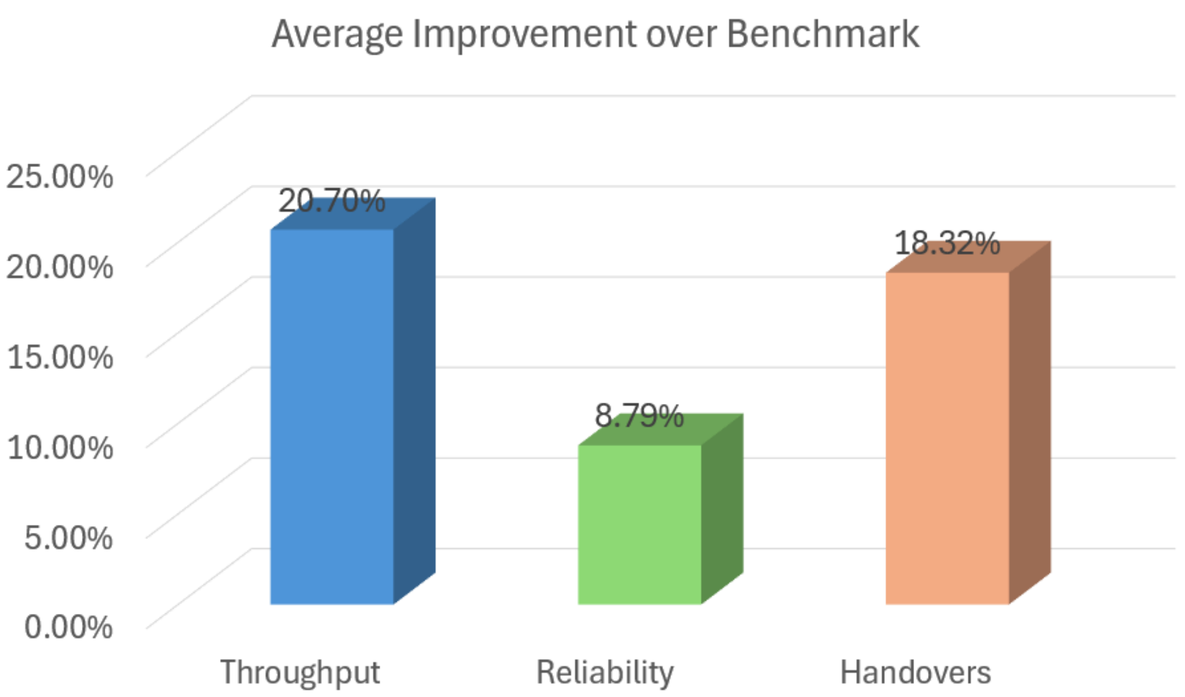


AI techniques such as Machine and Reinforcement Learning are employed to enhance communication performance and reliability through the introduction of new protocols and control schemes for the proposed UAV swarm architecture, achieving:

- Average increase in achievable network throughput by 20.7%.
- Average increase in network reliability under interference scenarios by 8.79%.
- Average reduction in unnecessary intra-network handovers by 18.32%.

CONCLUSION OF THE PROJECT

The proposed architecture enhances communication and handover performances when using decentralized wireless technologies for UAV swarms. It also enables seamless switching between different wireless technologies to improve connectivity, especially in remote areas. This architecture facilitates the reliable deployment of multi-UAV systems in multitudes of environments to drive innovative use cases in the industry.



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