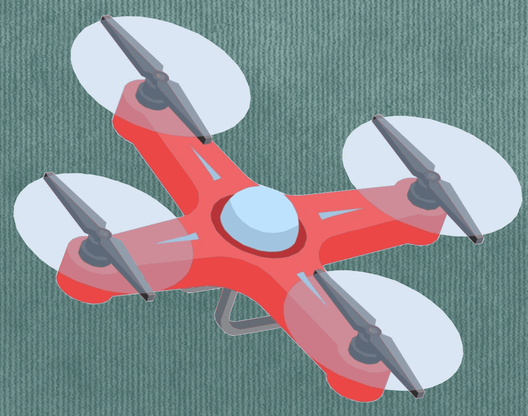
Maximizing Drone Potential

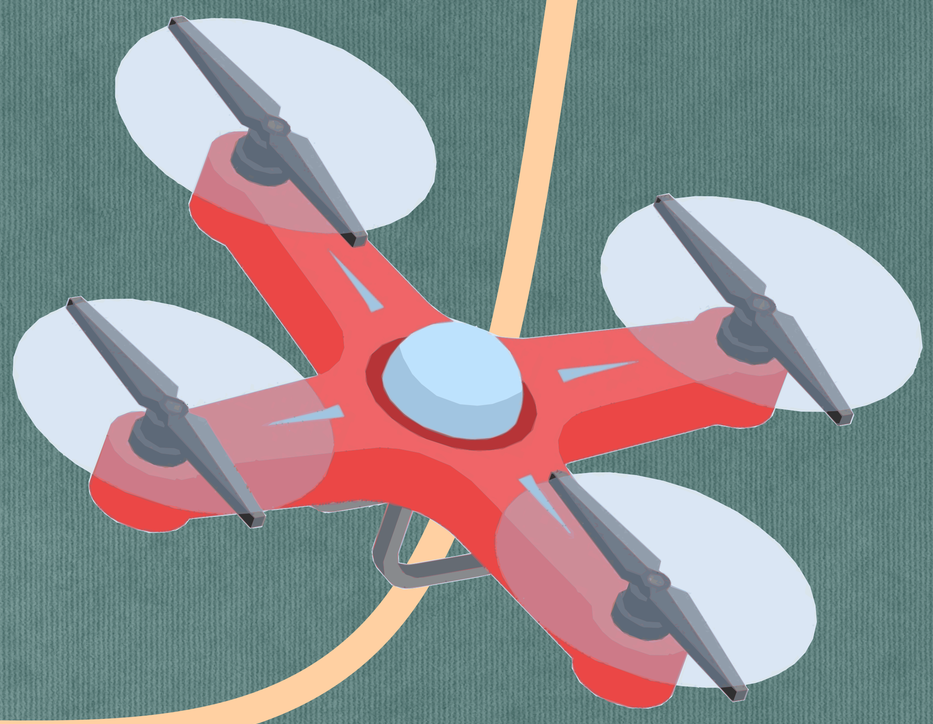


Take off

Fast but also safe

Challenges:
Sequential too slow
Simultaneous prone to collision

Solution:
Calculate collision
Take off in groups



Formation

preparation for take off

Challenges:

matching the ground with air formation
Many combinations are possible

Proposal: 3 algorithms

- Brute-force
- Heuristic
- Kuhn-Munkres (KMA)

Result:
KMA is the best option

Automatically adjusting altitude

Challenges:
Terrain altitude can change
and lead to collisions

Solution:
Control system based
on a PID controller

Result:
Responsive control
only 3% increase flight time

Maintaining the formation

Challenges:
Disturbances can break the formation

Solution:
Synchronization at each waypoint
build-in resiliences for failure of drones

Result:
Stable formations with almost no time overhead

Landing

On a precise location

Challenges:
GPS based is not accurate

Solution:
Camera based landing
guidance algorithm

Result:
Precise landing (+ 18cm)

Future works

Smart agriculture

Disaster management

Network infrastructure

ArduSim: a multi-UAV simulator

A need for a:
Open-source simulator
Multi-UAV
Accurate
Deployable on real UAVs

Results:
Highly scalable
Real-time
Distributed system
Fast deployment
Communication models
Flexible

Published research

Accurate Landing of Unmanned Aerial Vehicles Using Ground Pattern Recognition

Collision-free swarm take-off based on trajectory analysis and UAV grouping

Improving UAV Mission Quality and Safety through Topographic Awareness

Distributed management and coordination of UAV swarms based on infrastructureless wireless networks

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