**Drone Pollination V2**

**Drone-Enabled Autonomous Pollination System (APS):** [**HERE**](https://www.mdpi.com/2218-6581/10/1/3)

This project proposed a drone-enabled Autonomous Pollination System (APS) that consists of five primary modules: environment sensing, flower perception, path planning, flight control, and pollination mechanisms. They used a variant of the Traveling Salesman Problem (TSP) for path planning and compared two approaches based on mixed-integer programming (MIP) and genetic algorithms (GA), with the latter being chosen due to computational efficiency. They developed a convex optimization approach to solve the quadrotor flight control problem (QFCP) which allowed for accurate path following for pollination tasks.

**Autonomous Drone-Based Pollination System Using AI:** [**HERE**](https://www.researchgate.net/publication/373697199_Autonomous_Drone-Based_Pollination_System_using_AI_Classifier_to_Replace_Bees_for_Greenhouse_Tomato_Cultivation)

This project developed an artificial intelligence (AI) image classification system to identify flowers ready for pollination. The AI classifier helps the drone locate flowers for pollination tasks.

**Autonomous Visual Navigation for Flower Pollination Drone:** [**HERE**](https://www.mdpi.com/2075-1702/10/5/364)

A small drone was developed with visual navigation capability enabling it to autonomously approach flowers for pollination. This was a crucial step towards a fully autonomous flower pollinating nano drone, relying on a small on-board color camera and a Time-of-Flight (ToF) distance sensor for navigation.

**Drone Pollination of Flowering Vegetation for Agricultural Applications:** [**HERE**](https://asmedigitalcollection.asme.org/IMECE/proceedings-abstract/IMECE2021/85581/V004T04A023/1132592)

This project aimed at leveraging commercial drones to distribute pollen across large orchards or forested areas to supplement bee pollination. This large-scale pollination could benefit farming and forest conservation industries.

**Novel Path Planning Optimization Algorithm Based on PSO:** [**HERE**](https://www.mdpi.com/2227-9717/10/1/62/htm#:~:text=A%20novel%20path%20planning%20optimization,disadvantages%20of%20the%20traditional%20systems)

A new path planning optimization algorithm for UAVs based on PSO was proposed. This algorithm aimed to manage the drone’s distance and flight time by applying optimization and randomness techniques to overcome the disadvantages of traditional systems.

**Algorithms:**

* Particle Swarm Optimization
* Informed Swarm Optimization
* Traveling Salesman Problem
* Ant Colony Optimization
* Vehicle Routing Problem

**Changes:**

* Dynamically setting the size of camera/effect in mainAnimation

**Notes:**

* When a drone finds a flower, it uses PSO to create a 'pull' on other drones to that general location

**Issues:**

* Drones change their velocities based on nearby drones. So, when there's more than one in the safeDistance this can cause issues
* Drones over pollinated flowers shake rapidly and don’t know here to go

**Map Informed:**

***Informed PSO:*** With knowledge of the whole map, the PSO can be modified to be more "informed." Drones can be attracted not just by the average position of flowers needing pollination but also by areas of the map that have higher densities of unpollinated flowers.

***Layered Strategy:*** The drones can first employ a coverage algorithm, like the Boustrophedon Cellular Decomposition, to ensure that the entire field is covered efficiently. Once a drone covers a region, it then switches to PSO to refine its movement based on the swarm's behavior.

***Genetic Algorithms:*** This is a more complex approach, but drones can use genetic algorithms to evolve their paths over time, optimizing for shortest paths that cover the most unpollinated flowers.

***Reinforcement Learning:***Drones can use reinforcement learning techniques to learn the best paths and actions over time, getting rewarded for pollinating flowers and penalized for revisiting already pollinated ones or colliding with other drones.

**Shared Memory:**

***Centralized Knowledge Base:*** Implement a centralized database or data structure that holds the state of each flower (e.g., seen, pollinated). Drones would update this database whenever they visit a flower and can also query it to avoid revisiting flowers already pollinated by other drones.

***Distributed Systems & Consensus Algorithms:*** To ensure that all drones have consistent and synchronized views of the shared data, you can explore distributed consensus algorithms like Paxos or Raft. This ensures that even if some drones have a delay or fail, the overall system continues to operate reliably.

***Path Planning with A or Dijkstra's Algorithm\*:*** With global knowledge, drones can employ path planning algorithms to determine efficient routes that cover multiple flowers. For instance, they could use A\* to find the shortest path that covers a series of unpollinated flowers.

***Dynamic Task Allocation:*** Drones can employ dynamic task allocation algorithms to divide the field among themselves, minimizing overlap and ensuring efficient coverage.