

EXPO

engineering ▲ design

OBJECTIVE

Design and manufacture a prototype autonomous sprayer drone for precision agriculture that surveys fields, identifies weeds, and automatically sprays weeds.

KEY REQUIREMENTS

- Carry fifteen (15) lbs. of Payload
- Fly for fifteen (15) minutes
- Autonomously fly over a field and detect weeds
- Precisely spray detected weeds
- Dry weight of less than fifty (50) lbs.
- Diameter of less than fifty (50) inches

BACKGROUND

Commercially available agricultural drones can cost over \$10,000. Traditional agriculture drones use a crop-dusting method, wasting herbicide by over-spraying crops. Manually spot spraying weeds is time consuming and expensive. A precision spraying drone is a potential solution, efficiently spot spraying weeds at low cost.



VALUE PROPOSITION

- Food Insecurity is a growing problem worldwide
- Farming is often a heavily manual process
- Drones could help farmers have higher yields



SPRAYER DRONE FOR PRECISION AGRICULTURE

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Lead Instructor: Dr. Matthew Swenson

Mentor: Levi Bailey

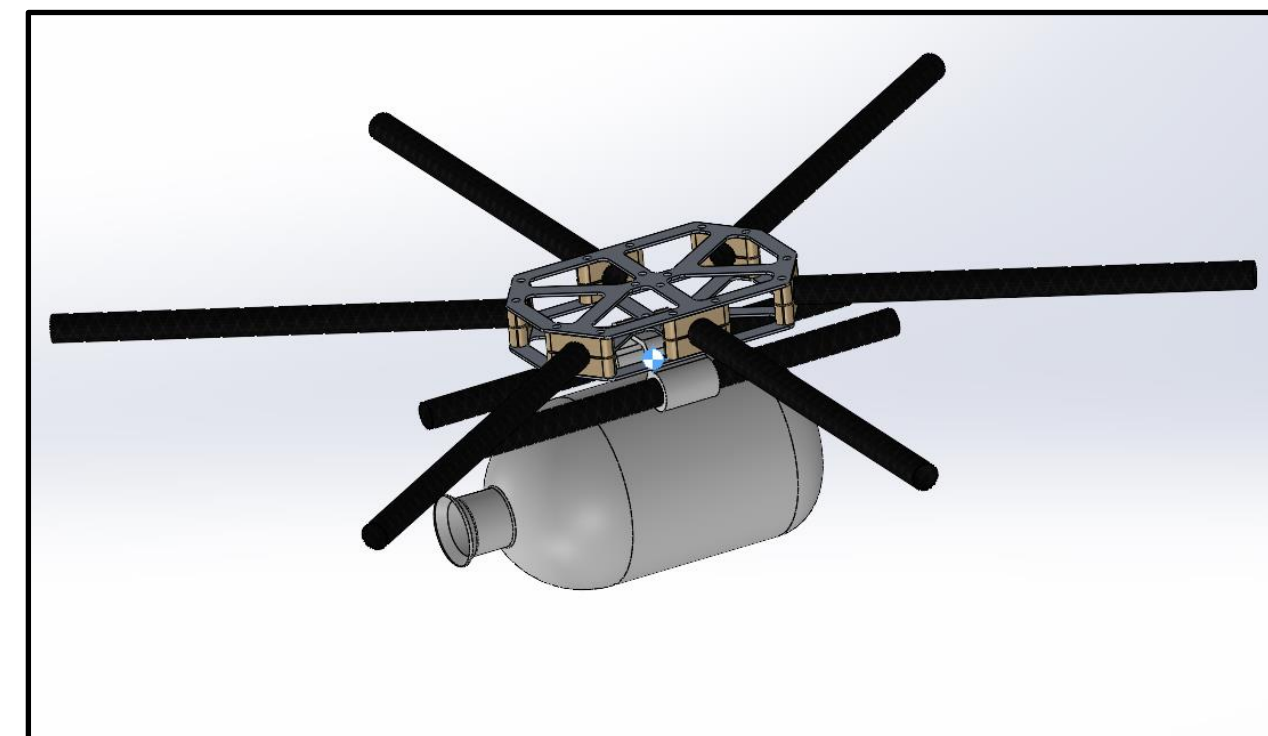
Sponsor: Dr. Jae Ryu – UI CALS



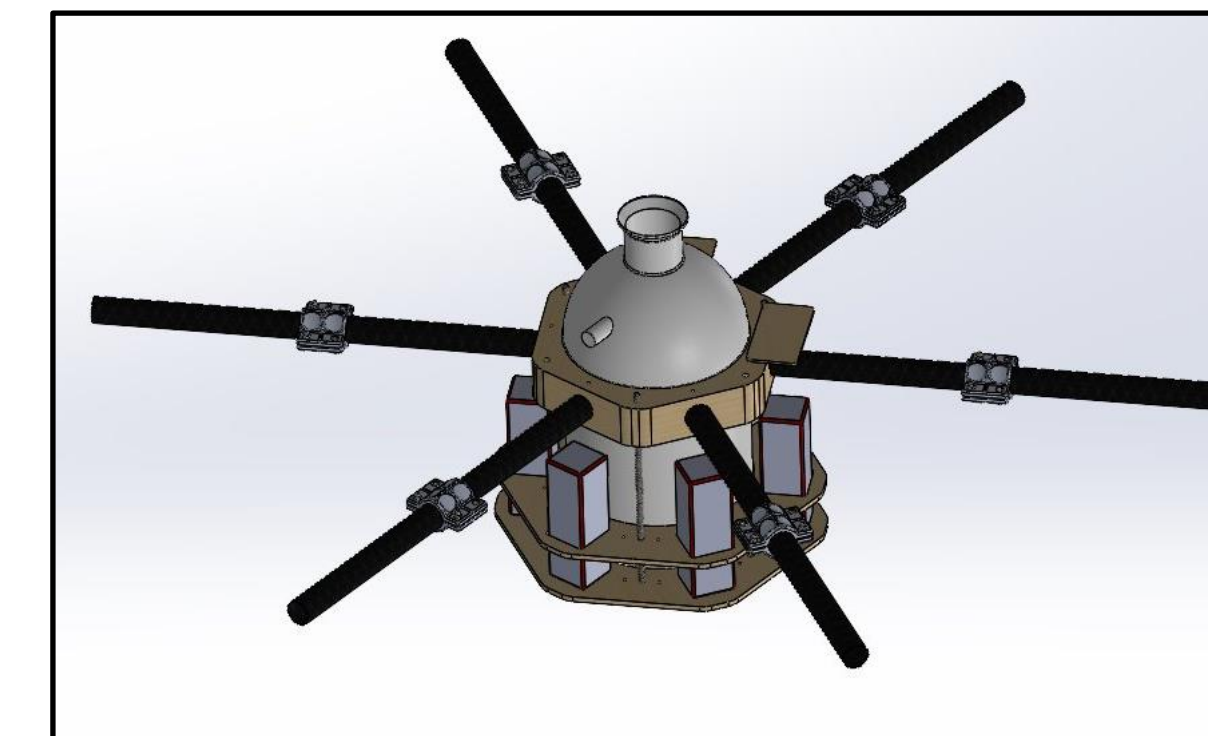
CONCEPTUAL DEVELOPMENT



Learning drone kit



Early concept brainstorming



Design refinement



Physical prototyping

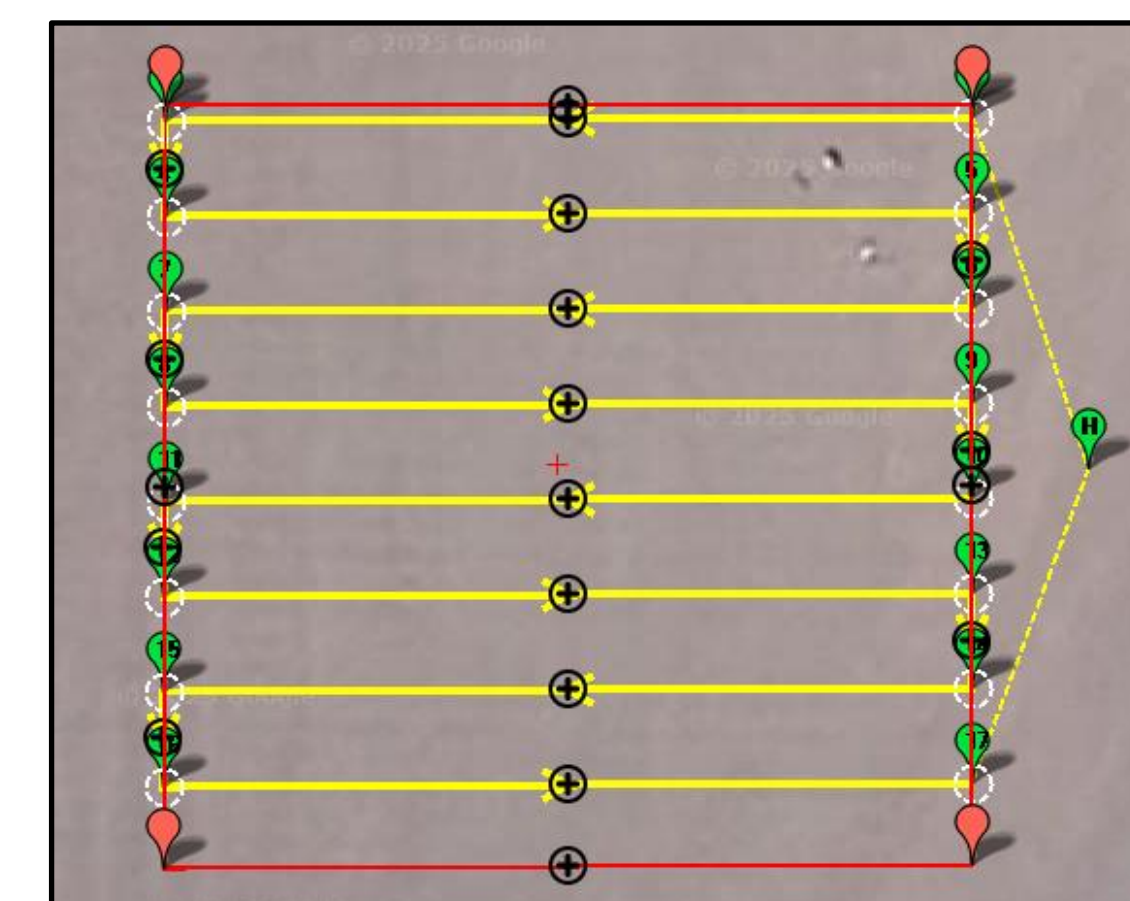
FINAL DESIGN



- Laminated laser-cut wood frame
- Generic 2-gallon spray tank and nozzle
- Onboard Raspberry Pi 4B companion computer
- AI Camera with TensorFlow model
- Gauge wire and bus bar power distribution

VALIDATION

- 15-minute 15-pound endurance flight
- Object detection test flight
- Object detection and spray test flight



Test Flight Plans



Detection testing on mock targets

CONCLUSIONS & RECOMMENDATIONS

- Concept is overall viable
- Train more AI models for new use cases
- Tune flight algorithm for increased efficiency
- Frame improvements for longer lifetime
- Weatherproofing for expanded operating conditions
- Increased battery capacity for extended flight time

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2025 Capstone Project

