

AI-IADSSCHM

(AI-Integrated Autonomous Drone System for
Smart Crop Health and Harvest Monitoring)

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Project Overview

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Use-Case

- Low-cost crop monitoring (~\$750)
- Farmers
- Simple/Easy to operate by users of all backgrounds
 - Simple user experience
 - Data presentation
 - Software compatible with a wide range of hardware
- Repairability!!!
 - Off-the-shelf components
- FAA Compliant (Part 107 License)



Project Overview

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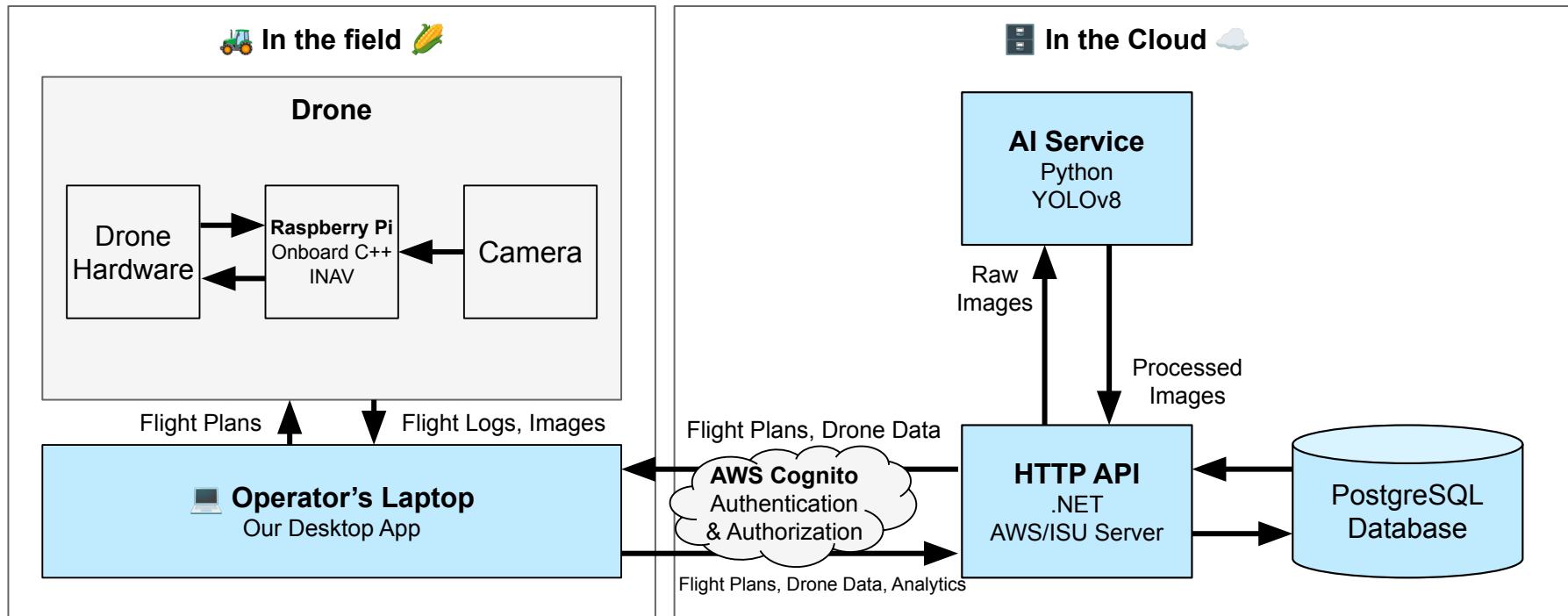
Technology

- AI vision model:
 - Classify growth stages
 - Detect indicators of disease/pests
 - Estimate yield %
- Desktop application with Cloud integration
 - Compute performance for the AI Model for a seamless experience



System Overview

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Creating a flight

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- Sign up/Login
- Google Maps API
- Intersection points for image capture locations
- Creating a flight

[Sign In](#) [Create Account](#)

Username

Enter your Username

Password

Enter your Password

👁

Sign in

[Forgot your password?](#)



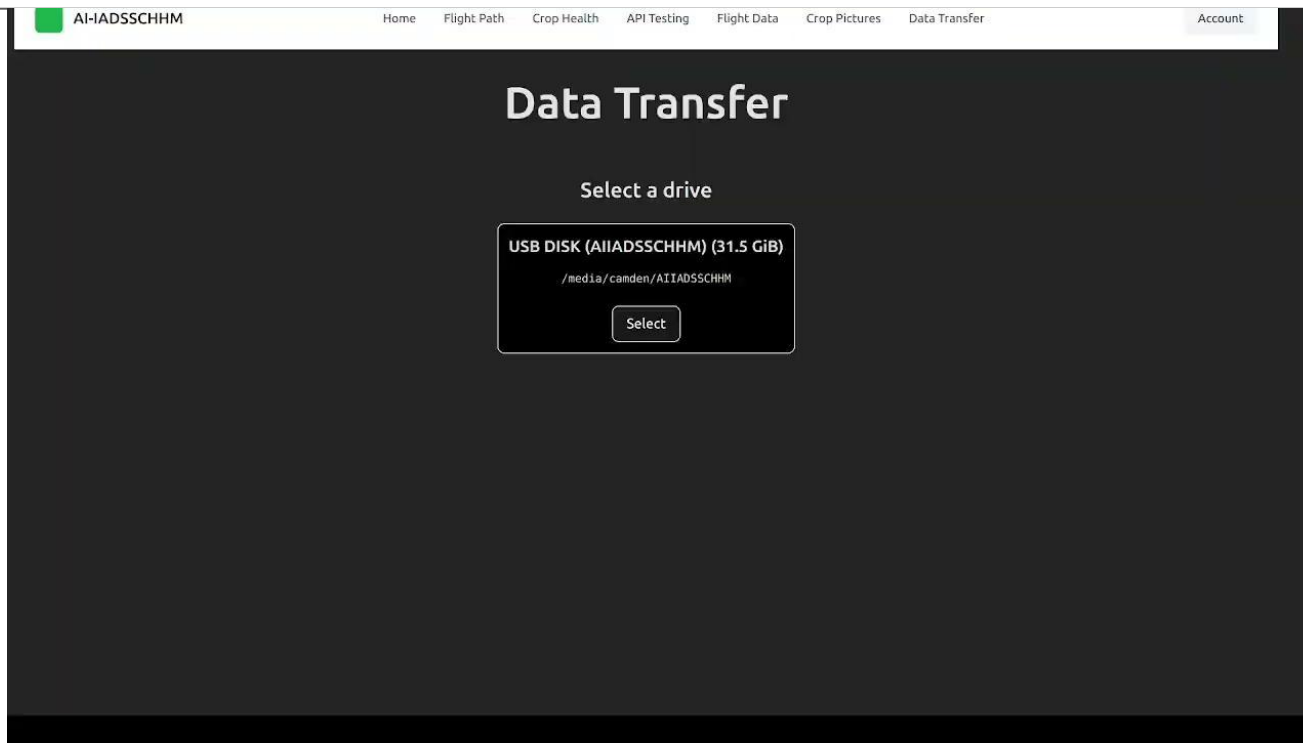
Creating a flight

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Selecting a Flight

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Drone Flight

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- Easy
- User turns on Pi
- Flight commences
- User must supervise flight
- In short time drone will come back
- And ready for analysis



Autonomous Flight Demo

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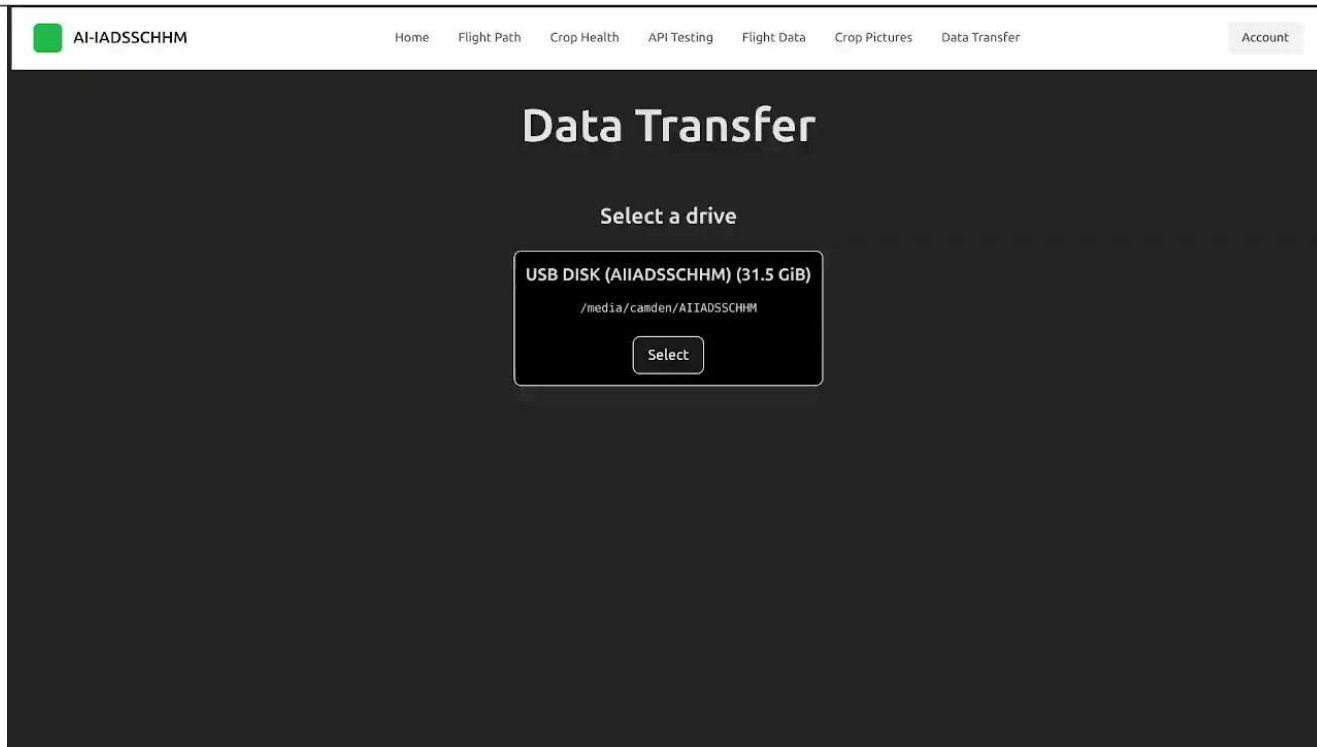
Storing Flight Data

- Once pictures are taken, drone comes back
- Plug SD card into computer
- Frontend scans drone logs for image logs
- Send those images to backend
- Look at analysis, create more flights, etc.



Storing Flight Data

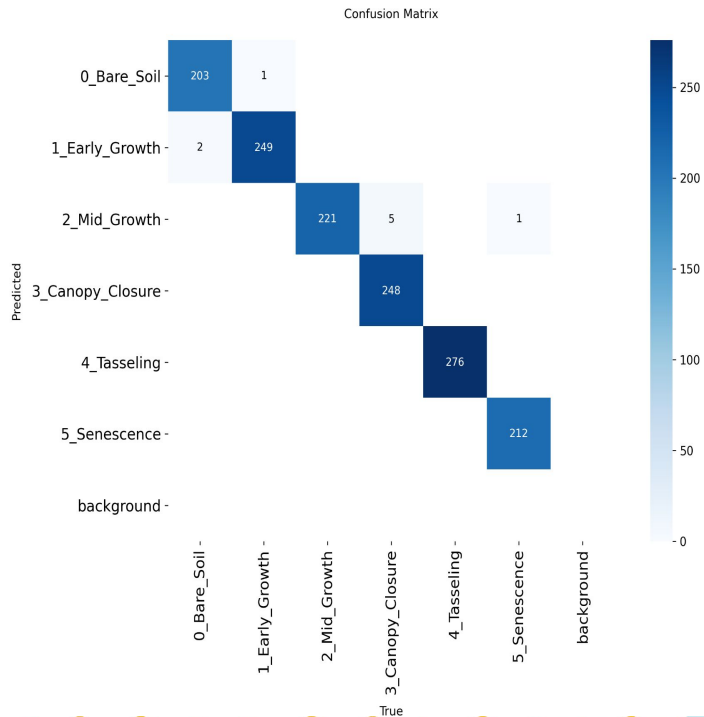
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AI Analysis Pipeline

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- **Architecture:** YOLOv8 CNN
 - Why? - amount of data, computation power
- **Dataset:** 100k+ Images (Auto-labeled via ExG/HSV)
 - From? - G2F (Genome to Field) Public Database
- **Scope:** 6 Growth Stages + Background Filter
 - Background? - Safely sort our dirt road, tractor etc
- **Training:** Nova HPC Cluster (GPU)
- **Performance:** 99.3% Validation Accuracy



Testing

- Automated testing
- Flight simulator
 - XPlane
 - INAV
 - Drone SW
- Real world testing
 - Safety precautions



Limitations/Next Steps

- Show analysis on the frontend for users
- Show drone images for human analysis
- No hardware implementation for scheduling
- Did not get a complete field test on corn
- The AI model only classifies the growth stage



Thank you

(Questions?)



Drone Details

- Flywoo FPV drone with FC flashed with INAV firmware
- INAV has autonomous waypoint missions
- Drone has multiple sensors
 - Magnetometer, barometer, and GPS
- Pi and FC are wired through UART
- Communicate with the MSP remote messaging protocol
 - Request-response protocol
 - C++ on Pi
- ELRS for radio control link between drone and remote controller
- Camera interfaces on Pi through libcamera stack

