

EE/CprE/SE 491 Weekly Report

09/10 - 09/17, 2025

sdmay26-20

AI Integrated Drone for Smart Crop Health and Growth Monitoring

Faculty Advisor/Client: Md Maruf Ahamed

Team Members:

- Jongmin Lee, jongminl@iastate.edu - Frontend/Backend/Hardware
- Z Harvey, zdharvey@iastate.edu - Frontend/Backend
- Andres Lopez, andresl4@iastate.edu - Hardware/Firmware
- Alex Pallan, apallan@iastate.edu - Frontend/Backend/Hardware
- Camden Senneff, csenneff@iastate.edu - Frontend/Backend/Hardware
- Caleb Zea, calebzea@iastate.edu - Frontend/Backend/Hardware
- Srdan Kopunovic, srdank@iastate.edu - Backend/Middleware

Summary of Work:

Met as a team to discuss and create a team contract. Discussed roles and responsibilities for each team member moving forward. Identified the project requirements, as well as determined team communication, organization, and roles. Discussed work for the back half of the week and what to research. Researched drones and different drone models to find one that would work for our use case. Additionally, researched the feasibility of constructing our own drone from off-the-shelf components.

Researched software solutions for backend systems, including database and cloud storage. Explored options for developing the frontend, including both web-based options, desktop, as well as mobile applications. Narrowed down the software candidates for the project frontend, with .NET MAUI and Electron remaining as the final two options. The goal is to make a cross-platform unified codebase for Windows, Mac, and Linux.

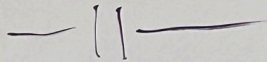
Identified Python as the programming language to be used for AI integration for the project, as well as narrowed down the options for the backend development to be decided between Python or .NET for simpler deployment. Selected PostgreSQL as the database to be used for storing telemetry, sensor, GPS data, and media files. Identified AWS services for cloud and authentication implementation for data storage and encryption.

Completed Initial system diagram sketch. We currently have two different ideas of how the data flow would go, and it depends on whether remote data transfer is possible or if we'd only be able to transfer through a direct wired connection.

System

Drone A

RC



Drone B



- mSD

- Pictures

- Coord

- Field Layout

→ Data

→ Client
(Desktop)

→ SQLite

↓
Cloud

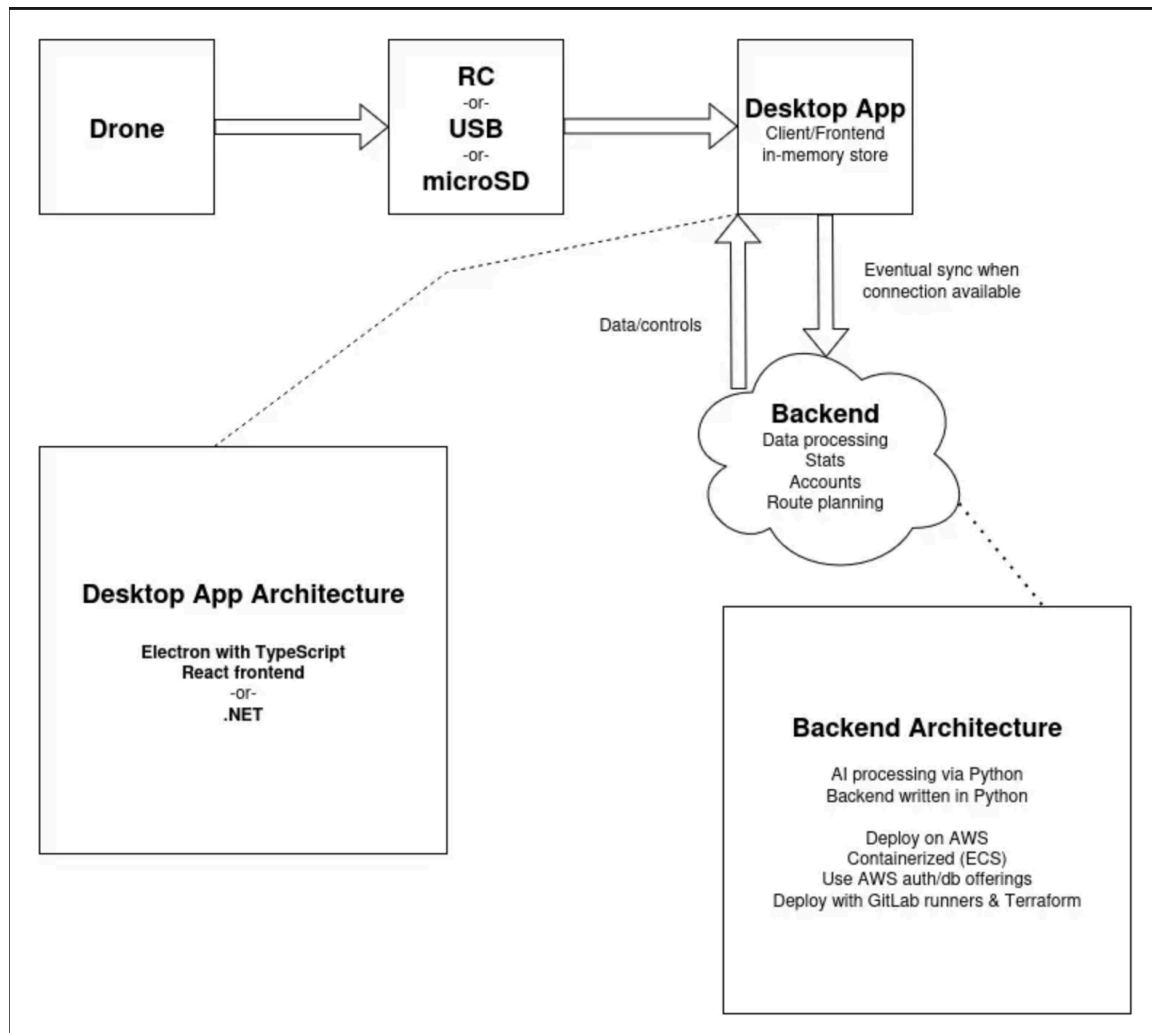
- Sync time

Work Period Accomplishments:

- Constructed team charter document
- Discussed architecture for drone build and control systems
- Researched potential drone candidates and the possibility of constructing one ourselves
 - Looked into off-the-shelf complete drone options
 - Looked into custom-built drone options (buy frame, controller, motors, ...)
 - Created a preliminary parts list for cost estimation
- Investigated potential firmware for drone and autonomous flight
 - Seen potential API's to look into, including ardupilot and px4
- Researched potential software for the backend system
 - Identified PostgreSQL as a database candidate
 - Identified S3 bucket as cloud storage for staging data
 - Researched PyTorch for potential AI use
 - Leading contender with AWS infrastructure
 - AWS RDS with PostgreSQL for the database
 - AWS ECS containers for processing (or AWS EC2 for a persistent Linux server)
 - AWS Cognito for user login and auth
 - Terraform + Github for CI/CD & infrastructure management
- Researched frontend software options for development
 - React + TypeScript for a web-based application
 - React-Native + TypeScript for cross-platform mobile application
 - CesiumJS, for 3D visualization
 - .NET MAUI for cross-platform desktop application

- Discussed a possible layout for the overall architecture of the system and each of its components

Preliminary System Diagram



Plans for Coming Week + Action Items:

- Jongmin Lee - Research and shortlist multispectral or high-resolution RGB cameras for plant health imaging
- Z Harvey - Research software options for the frontend, want something that is easily compatible with cameras. Ideally, have close to a stack of software by next week.
- Andres Lopez - Continue to refine hardware specifications for general drone and also potential specific modules. Look more into potential firmware to run on the drone, betafly, px4, ardupilot
- Alex Pallan- Create a Github/Gitlab for the team with a CI/CD pipeline
- Camden Senneff - Work with Andres and research and define requirements, and within that, put together a complete parts list for the drone so we can get costs approved and begin planning. Look into frontend options.
- Caleb Zea - research software components and implementations for the backend, as well as how to hook the Python AI model into the backend. Discuss with the rest of the team what methods and implementations will be necessary to couple the backend and frontend together.
- Srdan Kopunovic - Decide with the rest of the team what hardware is best to use for the project, layout the backend architecture plan, and set up the development environment.

Pending Issues:

- Jongmin Lee
 - Still evaluating the trade-offs between RGB, multispectral, and hyperspectral cameras. Each option varies in cost, weight, and data utility for crop health analysis.
- Z Harvey
 - Software choice for frontend
 - Method/Model for AI
- Andres Lopez
 - Understanding requirements and scope of the project within our constraints
- Alex Pallan
 - Understanding AWS/Cloud infrastructure requirements
 - Considering possible security measures that will become an issue
- Camden Senneff
 - Creating a feasible plan for the drone within all requirements while staying within the budget
 - Work with the team to determine the framework of choice moving forward in the frontend
- Caleb Zea
 - Awaiting answers to implementation and feature questions from the advisor.
- Srdan Kopunovic
 - Layout all the requirements for the project, including:
 - Do we need a multispectral camera for early disease detection or RGB for general purpose to integrate with AI
 - Does it require night capability (thermal camera vs adding light source to drone)
 - Battery life requirement, and does it require self charging capability
 - Final decision on software for developing frontend/backend

Individual Contributions:

Team Member	Contribution	Week Hours	Total Hours
Jongmin Lee	Researching which camera will be perfect fit for our project	4	4
Z Harvey	Looked into coding languages to use for frontend	5	5
Alex Pallan	Looked into cloud infrastructure and deployment options. Identifying potential vulnerabilities	3	3
Andres Lopez	Looking into hardware specifications and technical information for scope of drone	5	5
Camden Senneff	Researching options for drones and flight computer Researching frontend and backend options	5	5
Caleb Zea	Drone hardware research. Researched frontend logic and how to transfer information from the drone to the local database.	5	5
Srdan Kopunovic	Researched potential software solutions for database and cloud storage, and researched which approach to take for constructing the frontend.	6	6