

EE/CprE/SE 491 Weekly Report

10/29 - 11/04, 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 - Backend/AI
- Z Harvey, zdharvey@iastate.edu - Frontend/Backend
- Andres Lopez, andresl4@iastate.edu - Hardware/Firmware
- Alex Pallan, apallan@iastate.edu - Cloud/Security
- Camden Senneff, csenneff@iastate.edu - Frontend/Drone SW
- Caleb Zea, calebzea@iastate.edu - Frontend/Backend
- Srdan Kopunovic, srdank@iastate.edu - Backend/ Cloud

Summary of Work:

A lot of progress was made the past week, across all sections of the project. We have made progress in deciding on the hardware to use for surveying the fields. The next step is hearing back from ETG, and getting our drone parts in as soon as possible.

The Frontend team has developed a prototype UI to use as a template for refining user experience and navigation, created a project within Google to be able to use the Maps API, as well as created a placeholder for data received from the backend.

Backend has implemented the core logic, test, and API layer for collecting and manipulating flight data, as well as deployed the program to the team server for initial communication testing with the frontend. Additionally, the team has set up the project infrastructure and autodeployment for the cloud system.

Work Period Accomplishments:

- Frontend
 - Updated software versions
 - Made it so front page images scale with window size
 - Added front page images to a 2x2 grid, so they will maintain their shape and spacing
 - Removed leftover project initialization objects from the page
 - Added basic pages for each of the links in the nav bar
 - Removed unnecessarily implemented className abstracts
 - Implemented basic API calls with backend, currently just point to a test GET call
 - Connected with Google's cloud API to pull satellite images to display to on frontpage
- Backend
 - Deployed to Team Server for initial test
 - Models Implemented:
 - `Flight { flightId: long, flightDateAndTime: date-time}`
 - `FlightData {`
 - `flightDataId: long,`
 - `startBatter: int [0-100]`
 - `endBattery: int [0-100]`
 - `flightStartTime: time`
 - `flightEndTime: time`
 - `flightId: long`
 - `locations []: Location`
 - `}`
 - `Location {`
 - `locationId: long`
 - `latitude: double`
 - `longitude: double`
 - `altitudeInMeters: double`
 - `timestamp: date-time`
 - `flightDataId: long`
 - `}`
 - DTO:
 - `FlightCreateDto { flightDateAndTime: date-time}`
 - `FlightUpdateDto { flightDateAndTime: date-time}`
 - `FlightDataCreateDto {`
 - `flightDataId: long,`
 - `startBatter: int [0-100]`
 - `endBattery: int [0-100]`
 - `flightStartTime: time`
 - `flightEndTime: time`
 - `flightId: long`

```

        locations []: Location
    }
    ■ FlightDataUpdateDto {
        flightDataId: long,
        startBatter: int [0-100]
        endBattery: int [0-100]
        flightStartTime: time
        flightEndTime: time
        flightId: long
        locations []: Location
    }
    ■ LocationDto {
        latitude: double
        longitude: double
        altitudeInMeters: double
        timestamp: date-time
    }

```

- Cloud
 - AWS account is operational and everyone in the group is able to log into it
 - GitLab CI/CD runner is able to run and deploy infrastructure to our cloud account
 - Terraform state is saved in our GitLab repo to avoid duplicate infrastructure being deployed on every push to the main branch
- Drone
 - Met with Dr. Jones to talk over drone specifications and safety requirements.
 - Submitted and got approval for a finalized drone build.
 - Implemented UART and MSP (FC to Raspberry Pi communication protocol) with unit testing.
- AI
 - Evaluated GPU training feasibility using Nova HPC cluster (A100 nodes) and estimated dataset training time.
 - Began initial research on crop health detection models using public agriculture datasets
 - Defined model goals for early-stage simulation, focusing on pest detection, canopy density estimation, and crop classification.

Plans for Coming Week + Action Items:

- Jongmin Lee - Begin setting up baseline training for the crop health detection model using the selected dataset. Finalize preprocessing scripts and evaluate model performance on sample images.
- Z Harvey - Continue to work on the Google API map to try to show flight path and grid overlay that actually looks good. Once this gets done, test with mock flight data to see how to set zoom variables and field size to display on the frontend.
- Andres Lopez - Discuss with our advisor in the meeting this week to see progress on drone. If it can get here by next week then build and work with Camden on implementing basic functionality on the drone to test.
- Alex Pallan - Moving the database to PostgreSQL with Srdan Kopunovic as well as starting to implement and experiment with authentication with Amazon Cognito will be my priorities for this week.
- Camden Senneff - Since we have landed on an approved drone build, I will implement methods in our drone controller software to take images and talk with the flight controller.
- Caleb Zea - Add in the rest of the API calls to the backend and start working on other data pages
- Srdan Kopunovic - Migrate Database from MySQL to PostgreSQL. Create API layer for image transfer between frontend and backend, implement image transfer between backend and image processing service. Start implementing user authentication

Pending Issues:

- Jongmin Lee
 - Currently limited by the availability of high-quality crop datasets for training and validation. Need to confirm access or finalize simulation dataset before proceeding with full model training.
- Z Harvey
 - I'm a bit unfamiliar with advanced JS coding so I'm struggling with implementing the overlaying JS needed on the google API map while making it look good. Just taking more time than ideal.
- Andres Lopez
 - Communicate with Camden on drone software to agree on what the firmware will require and how we will split up working on it.
- Alex Pallan
 - I am not familiar with the database we will be using or any of the configuration we will be using, so working with Srdan will be a priority for that
 - Cognito is not a service I am super familiar with, so researching what that will look like and how to implement it in all of our code will be a priority.
- Camden Senneff
 - The drone pilot software will remain relatively untestable until we have our hands on hardware. I will work to implement some extensive unit testing in the meantime to improve testing time later.
- Caleb Zea
 - I am currently receiving a network error from Axios when attempting to make a GET request to the API; however, the test GET call to tecktip.today is successful, and none of the formatting between the functions differs
- Srdan Kopunovic
 - Refine data flow between backend and frontend communication, in order to better adjust for UI needs

Individual Contributions:

Team Member	Contribution	Week Hours	Total Hours
Jongmin Lee	Contributed to developing the AI subsystem by researching and selecting public agricultural datasets, designing the preprocessing pipeline, and defining the architecture for the crop health detection model.	8	34
Z Harvey	Connected with Google's cloud API, giving access to 21+ APIs that we can use in our software. Needed to make a cloud project and enable billing and a unique API key. Tried a rudimentary API that pulls a PNG of satellite imagery based on parameters (longitude, latitude, zoom, etc) but it was too basic for our needs so now I've implemented the more advanced API that uses JS, so the imbed can be overlaid and programmed, which fits our needs much better but is more advanced.	8	29
Andres Lopez	Reviewed the current drone software code. Also reviewed that Betaflight isn't the best choice of software for the drone as INAV seemed better for the project.	5	19
Alex Pallan	Helped work on the Lightning talk document. Also created and configured the terraform GitLab runner to authenticate properly with our AWS account, as well as store the terraform state in the GitLab repo with those corresponding credentials.	9	23
Camden Senneff	Drone UART and MSP work – made an implementation that compiles for Pi and unit tests on any architecture using a mock interface. Worked to finalize the drone build and compile information for that. Merge request reviews.	6	42
Caleb Zea	Lightning Talk work, image scaling, updated React version, added temporary images, removed leftover items from project initialization, removed unnecessary frontPageData property, added temporary images onto a grid, made it so template images scale, added remaining template pages, and implemented some basic API calls, fixed CI pipeline issues	9	41
Srdan Kopunovic	Fully implemented backend Core Logic, Unit Tests, and API layer for flight and location data. Deployed test version to ISU team server for UI prototyping and data transfer refinement. Did additional research for project flow to compliment in class presentation.	8	42