

VISION STATEMENT

CS Capstone | Fall 2020

Team

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Project Title SmartFarming

Company AgMonitor

Team Name PowWow++

Project Summary

With a constantly expanding global population, the impact of COVID-19, and the growing number of natural disasters, the agriculture industry is facing increasingly difficult challenges. It needs to cut back on its costs, and find more efficient irrigation and fertigation techniques.

The goal of the project is to reduce inefficient irrigation techniques, cut back on costs, and grow better crops by making available to Ranch Managers and agronomists real-time data collected from field sensors about water use, soil moisture, and other metrics, allowing them to optimize watering and fertilization schedules. Specifically, making that data available in a mobile application — a portable and user-friendly medium.

Problem Description

According to current research, the world will need 80 percent more calories by 2100 to feed an exploding population. However, under the impact of COVID-19 and natural disasters like wildfire, the development of agriculture is facing a challenge. Therefore, an effective farming decision-support mobile application with real-time data analysis is needed to increase irrigation efficiency and usher a generation of energy-conserving farming.

Additionally, there is currently a data gap among the farm workers. Agronomists and Ranch managers often have conflicting views on how to manage the crop. This work will help improve their communication and allow more efficient farming.

Why is it important

- More calories will be required in the future to feed the growing population
- Inefficient use of water and wasteful irrigation techniques contribute to climate change
- Irrigation efficiency can drastically reduce costs expended by fields
- Efficiency helps grow longer-lasting, higher quality crops
- Bridging the gap between ranch managers and agronomists
 - Currently a large portion of ranch managers are skeptical of the agronomists' opinion on the field, due to a lack of data
 - This technology may be able to help

Current Existing Solutions

Currently, a lot of agronomists use either pen and paper or haul their laptops out to the field when conducting field inspections. Another way they do it is by extracting a memory card from the on-site sensors and transferring that data to their laptops. On top of that inconvenience, agronomists look at the data that was collected only every 2 weeks.

AgMonitor has an existing mobile application that is optimized for the irrigators but does not show data that would be useful to ranch managers and agronomists. There are also many features that are only available on web applications, which makes it difficult for ranch managers to upload data edit plans for their crew on the field. There exist other competitor applications, but the graphics/charts are difficult to use.

Project Goals

- Learn about customer discovery process and design brainstorming
- Improve operational efficiency among field workers
- Build something that could become part of a commercial product
- Allow efficient data upload for ranch managers through mobile application
- Show a working demo of the mobile application
- Stretch Goal: conduct a real field trial

Project Outcome

With the data provided by AgMonitor, our team aims to create a farming decision support tool that leverages machine learning to solve agriculture problems on a simple and practical mobile application that will allow our clientele to conserve water. The data we acquire will be from various sources and forms such as: sensors tracking water evaporation, satellite imagery, and groundwater data to create a comprehensive machine learning model that can be easily applicable to any farm.

The mobile application will be built upon the existing AgMonitor web and mobile application. It will have a suite of features that will work concurrently in order for farmers to plan and manage how they irrigate and fertilize their fields. We will create an advanced scheduler that will use data to find the optimal time to irrigate and fertilize the fields. Additionally, we will update permission to better support ranch managers to upload data and organize our analysis of the data using a simple user interface that will break down data in a way that will be simple for workers to understand.

Solution Implementation Details

Some technologies we will have to utilize for data storage and for the web application:

- PostgreSQL
- Firebase
- Python, NumPy, Pandas, Scikit-Learn
- Django
- Flask
- React Native
- Javascript

For the mobile application we will rely on:

- React Native
- Android, iOS

Some other needed tools:

- API's: Google Maps
- Docker
- Windows WSL

Milestones

1. Research design exploration and validate with potential users/research partners
2. Understand current system and design new features based on current mobile and web applications
3. Implementation Ideas:
 - a. Sensor data display and analysis
 - b. Compute and display hours since last irrigation
 - c. Replace Google Map with Mapbox to have better offline operation
 - d. Allow ranch manager to edit calendar and add new items for their crew using mobile app in addition to web app
 - e. Define and build an offline mode for sensor data display in the mobile app
4. Stretch Goals
 - a. Show irrigation status, issues, and chat feature within the web application
 - b. Update permissions and the display to better support multiple ranch managers with different areas and crews
5. Test the mobile application with real-time data