SRS Template

Product Owner	Minnesota Corn Growers Association	
Agriculture Lead	Samikshya Subedi	subed036@umn.edu
Engineering Lead	Greg Kohler	kohle147@umn.edu
Required Approvers	Jude for Minnesota Corn Growers Association	

Overview

Our main objective for this is to build a system that updates daily with current and past growing degree days, current and past soil moisture, and current and past reference evapotranspiration. This data will be visualized through web maps and will be pulled from an API in GeoJSON format.

We're tackling a big problem: helping farmers and agriculture experts make smarter decisions. Our project provides them with crucial data about things like weather, soil moisture, and how plants use water. Currently, this data can be hard for the average farmer to interpret and is spread throughout different sources.

Who It Affects: This project impacts farmers who want to grow more crops efficiently, and more specifically corn farmers in Minnesota. Researchers who study plant growth, and anyone who cares about sustainable farming.

Why It's Important: Providing this data isn't just helpful; it's vital. Farmers can grow more food, researchers can make breakthroughs, and we can contribute to sustainable agriculture. Plus, our project aligns with our business's mission to support and advance agriculture.

Motivation

The motivation for prioritizing this project lies in the critical need for up-to-date agricultural data, particularly concerning growing degree days, soil moisture, and reference evapotranspiration. This data is indispensable for the agricultural community, including farmers, agronomists, and researchers, as it empowers them to make informed decisions about crop management, irrigation, and planting schedules. Successful delivery of this project is expected to result in several positive outcomes. It will provide users with timely access to crucial data, improve crop management practices, support agricultural research efforts, and ultimately lead to greater stakeholder satisfaction. The Minnesota Corn Growers Association has expressed a strong interest in this project and will actively participate as design partners to ensure that the system meets their specific needs and expectations.

Definitions

GeoJSON: GeoJSON is a way of representing geographical data using a format similar to how data is organized in JavaScript objects. It's commonly used for storing and exchanging geographic information.

GDD: Growing Degree Days are a measure of heat accumulation over time. They help in estimating the growth and development of crops based on daily temperature data.

Soil Moisture: Soil moisture refers to the amount of water present in the soil. It's an important factor for plant growth and irrigation management.

Reference Evapotranspiration (ET0): Reference Evapotranspiration is an estimate of how much water would be evaporated and transpired by a hypothetical reference crop under specific conditions. It's used to determine irrigation needs.

API (Application Programming Interface): An API is a set of rules and protocols that allow different software applications to communicate with each other. In this context, it's a way to retrieve data from an external source.

User Authentication: This is a security measure that ensures only authorized users can access the system. Users need to log in with their credentials (like usernames and passwords) to use the system.

Database: A database is a structured collection of data that is stored and organized for easy retrieval and management.

Scope

This section describes the scope of the project. It describes the functional and nonfunctional requirements as well as what items are out of scope for this iteration of the project.

Functional Requirements

Growing Degree Days

- Essential: NOAA - Daily gridded temperature and precipitation for the United States. Records kept since 1951. 5 km grid with an API.

Soil Moisture Data

- Essential: NASA SPoRT-LIS 0-100 cm Soil Moisture Percentile - Has current soil moisture conditions. 3km grid and updates quickly.
- Nice to Have: Soil Survey Geographic Database - Has maps and tables with soil data for the country.

Evapotranspiration

- Essential: National Weather Service - Has historical temperature, relative humidity, wind speed, and solar radiation data. Available as a GeoJSON. Data should be gridded.
- We can also see OpenET but no API access.

Web Interface
- Essential: Web map with raster data.
- Nice to Have: User interaction.
- Optional: Multiple web maps, users can get their current location.

GeoJSON API
- Essential: Google Cloud API REST Services will be used to pull the data when requested by user for a specified location
- Nice to Have: Users could pull multiple locations at once.

Non-Functional Requirements

Usability
- Essential: Data is easy to interpret, especially for those with little experience with web maps.
- Nice to Have: Data is thoroughly documented and a README will be required to read before using the data.

Performance:
- Essential: Will produce results for the state of Minnesota daily.
- Nice to Have: Data can be pulled quickly.
- Optional: Data is updated whenever a user requests it (more than just daily).

Reliability
- Essential: Data can be pulled anytime, from anywhere without interruption.

Security Requirements:
- Essential: Limit the amount of times data can be pulled within a certain timeframe.
- Nice to Have: Send alerts if some anomalous activity occurs.

Out of Scope Requirements

- Data outside of Minnesota
- High resolution data
- Crop evapotranspiration
- Soil quality

These are requirements that we are deeming out of scope for this iteration of the project. We list them here in order to be unambiguous and entirely clear with respect to project scope.

Persona Acceptance Criteria

Who are the stakeholders impacted by the project's success? What are they trying to achieve?

As a I developer I …
- Require access to data and APIs so that I can have access to the data and do analysis.

- Require credentials for web building and operating so I can create a successful web interface.

As an Operator I…

- Require quality control and assurance process so that I can ensure data with little to no errors is being provided.
- Require reliable sources of data so that I can maintain the data and the ability for users to obtain it.

As an end user I…

- Require current and daily data so that I can make real time decisions.
- Require a web interface so that I can easily visualize and use the data provided.

Open Questions

- Currently all of the data is gridded, but in different resolutions, how will all of this data interact?
- Not all of the data updates at the same time, how will this impact our claim of having the data updated daily.
- What is the cost?
- How simple does the data need to be?
- Will using data for the entire state cause a loss of efficiency in the API?

What are assumptions we are making and known risks with respect to the feasibility of a project? This can be with respect to licensing, staffing, or how a particular requirement will be achieved. All open questions must be addressed by the design stage.

Dependencies

- ArcGIS Online
    - Experience Builder
    - Web Map
    - Web Apps
- ArcGIS Pro
- Google Cloud
- GitHub
- NOAA
- NASA
- Soil Survey Geographic Database
- National Weather Service
- PostGIS
- Flask

Timeline:

Time	Objective	Task
2 weeks	Planning	Define project scope,Outline system architecture
3 weeks	Data Integration and API Development	Get essential data sources
3 weeks	Web Interface Development	Develop basic web interface.
2 weeks	Testing and Refinement	- Conduct usability and functionality tests
10 days	Final adjustment	Final system adjustments, Complete documentation, Deployment preparation and execution.

References

This subsection should provide a complete list of all documents referenced elsewhere in the SRS; This information may be provided by reference to an appendix or to another document.

- https://www.ncei.noaa.gov/metadata/geoportal/rest/metadata/item/gov.noaa.ncdc:C01589/html#
- https://www.drought.gov/topics/soil-moisture/data
- https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx
- https://www.weather.gov/documentation/services-web-api
- https://experience.arcgis.com/page/landing
- https://console.cloud.google.com/
- https://github.com/
- https://flask.palletsprojects.com/en/3.0.x/
- McMaster, G. S., & Wilhelm, W. W. (1997). Growing degree-days: one equation, two interpretations. *Agricultural and forest meteorology*, *87*(4), 291-300.