Universidad Politécnica de Aguascalientes

Computational Systems Engineering

Integrator Project Agronova

Smart Irrigation System

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Intelligent Irrigation System as a Service

Executive Summary

Agronova is an IoT-based smart irrigation solution to help farmers and crop managers optimize irrigation. Initially designed for corn crops, Agronova meets the minimum required for this type of crop, and is projected to expand its capabilities to other crops in future releases.

The system uses a Raspberry Pi with a battery included for energy autonomy to be charged with solar panels already integrated into the system and a cellular SIM card to provide internet access. This system collects sensor data (1 air temperature and humidity sensor, 1 soil humidity sensor, 1 SIM7000G module for the SIM card), sending all the information to the cloud (Azure), to be consulted from a mobile application.

Product Description

Product name: Agronova

Overview

The system consists of a mobile application and a system on a raspberry.

Raspberry system:

This system consists of a humidity and temperature sensor, a water pump, a soil moisture sensor, a solar charged battery and a SIM card module for internet access.

It is designed to send the crop statistics and receive instructions from azure or from the web application, considering that the internet connection will be intermittent, the system will save the information from the sensors in a json file that will be synchronized with the database at the moment of connecting to the internet.

Mobile application:

To enter the application you need authentication with azure, inside this you will find a real-time multimedia of your crop within the capabilities of the raspberry and crop statistics.

- Humidity (in the air and in the soil)
- Temperature

In addition, it is planned that the irrigation order can be automatic, at the moment the user decides or programmed.

Scalability as SaaS

By scaling as SaaS, Agronova allows management for multiple users and crops, this through a monthly subscription in the application. Its initial focus on corn will be progressively adjusted to offer compatibility with a variety of crops, which will increase its market and utility.

Agronova SaaS key features

- Real-time monitoring and control: Humidity parameters, temperature, and weather forecasts, adjusting irrigation automatically.
- Secure login with validation in Azure: Ensures data privacy and facilitates user management in the application.
- Data analysis and recommendations: Based on historical data and weather forecasts.
- Configurable multi-tenancy: Each user has secure access in the cloud, with shared or dedicated configurations depending on the subscription plan.

The monthly subscription cost includes a subscription to a mobile data package to upload crop data to the cloud.

Competitive analysis

- **Agrofacto:** Company located in the city of Aguascalientes, Aguascalientes. This company provides various services of technology equipment for irrigation crop control, such as weather stations, water level monitoring for wells, remote control of irrigation valves, among others. They also build greenhouses, automate and maintain them. In the irrigation systems area, what they offer is the installation of irrigation systems (drip, hydroponics, fertigation), materials and automation. The part where Agronova competes is in irrigation automation, since both Agronova and Agrofacto include the implementation of sensors to monitor crops and irrigation parameters in real time. What Agronova proposes to do is basically the same as Agrofacto, obtaining data through sensors on the crop, uploading that data to the cloud where it is processed and the user can obtain graphs of the situation of his crop, as well as the other components work automatically to satisfy the irrigation of the crop. Therefore, it is our most direct competitor in terms of what we offer.

Image 1. AGROFACTO company logo

Source: https://agrofacto.com/

- **Grupo hidráulica:** Based in Peru, this company offers mostly products focused on crop irrigation, such as pipe cutters, valves, motors for water pumps, and among those products it also offers irrigation automation by implementing the use of sensors. It is not such a direct competitor since it is not yet established in Mexico, but it does seek to position itself. On the other hand, they do not offer monitoring of the data obtained by the sensors through a mobile application; what they propose is an automation system where these sensors send information to a central controller that, based on the data received, activates or deactivates the irrigation systems, adjusting the amount and frequency of water supplied; but if the user wants to know the status of his crop he has to go directly to see it.

Image 2. GRUPO HIDRAULICA company logo
Source: https://grupohidraulica.com/

- **EOS DATA ANALYTICS:** It is a company based in the United States of America. They offer several options to implement in the agricultural sector, such as crop condition monitoring, water stress analysis, crop yield prediction, crop zoning, as well as other software solutions such as API's for other companies to acquire and use. The main differentiator of this company is the way in which crop data is collected, since it is done through satellites orbiting in space and through these they obtain data and images to process them and provide a diagnosis of the crops. This allows early detection of crop risks, reduction of input costs, monitoring of large fields, yield monitoring, API access to satellite data, among other aspects that the customer can monitor from home; in addition to the fact that some actions are powered by AI. Similarly, the use of satellites allows to exponentially expand its market because it is more accessible to other countries, it is not necessary to travel from one country to another to install monitoring sensors.

The lack of monitoring with sensors placed on the crop does raise the question of whether what they offer is true and reliable, but on their website they show comments from customers from different countries that affirm their effectiveness. On the other hand, they do not offer an irrigation automation system or infrastructure installation.

Image 3. EOS DATA ANALYTICS company logo
Source: https://eos.com/es/

Advantages and disadvantages

Advantages

Agronova offers a wide coverage in terms of its operation since it involves the irrigation automation system and the monitoring of the state of the crops. Some companies mentioned only offer one or the other, this closes the accessibility to the customer.

Agronova can be above Grupo Hidráulica since it offers the application for remote monitoring of crop status without the need to go to the field to make the review both for the consumption of crop data and the review of images in real time, besides this company is not yet established in Mexico.

Agronova offers the crop irrigation automation system, a feature that EOS DATA ANALYTICS does not offer since it only focuses on satellite monitoring.

Disadvantages

Agronova has to compete directly with Agrofacto since they both offer the same thing. Agrofacto is a company already established in the city of Aguascalientes with several years of experience providing more services and developing technology for crop improvement and optimization.

In terms of software coverage, Agronova is below EOS DATA ANALYTICS, since this company has a highly developed infrastructure for crop monitoring with its satellites and the implementation of API's for better crop control; in addition, EOS has a worldwide coverage, any country can use its services.

Agronova has good potential due to the vision and improvements for the agricultural sector in what it offers compared to other companies already mentioned in the competitive analysis. It offers the implementation of technology that will allow better

time management of customers, as well as a considerable increase in crop quality and savings in the consumption of economic resources and materials that are made year after year with traditional agriculture. It is also considered to be a considerably more accessible and usable option compared to the others mentioned, since some of the features offered by Agronova are not offered by others.

Market target

The target market is the agricultural sector where the infrastructure for the irrigation system has already been built and is seeking to optimize water use and improve crop quality, as well as a more precise control of the crop to achieve a better harvest. As mentioned in the subscription options, the customer is expected to pay for a monthly subscription to continue supporting the service according to their needs. Prior to the subscription plans, an opening fee will be charged for the acquisition of components such as raspberry cards, sensors and installation of components, this cost will be proportional to the coverage that is covered in the crop with such components.

Subscription options

Agronova will offer 3 monthly subscription packages for crop irrigation monitoring and automation:

- Basic: monitoring of basic aspects of the crop such as, soil moisture, ambient temperature, imaging, automatic irrigation, annual sensor review and maintenance.
- Intermediate: basic package plus disease detection, data analysis of more crops.
- Premium: intermediate package plus improvements and suggestions for implementation of an artificial intelligence model.

The monthly subscription cost includes a subscription to a mobile data package to upload crop data to the cloud.
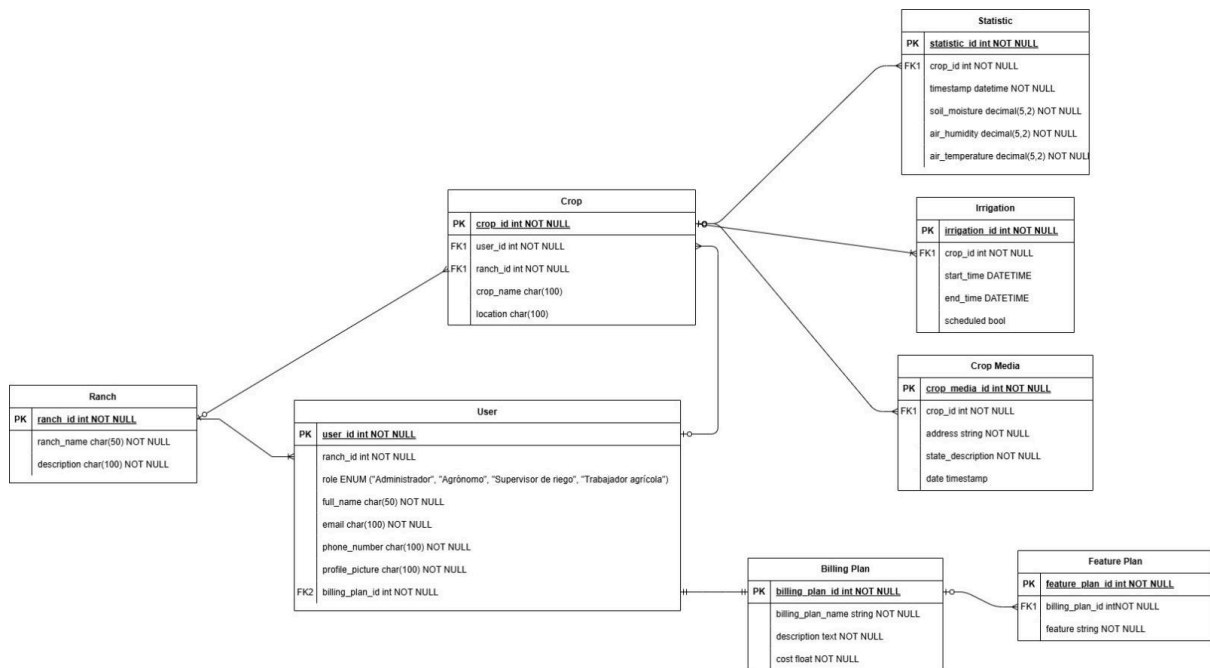
Entity Relationship Diagram

Image 4. Database Entity Relationship Diagram
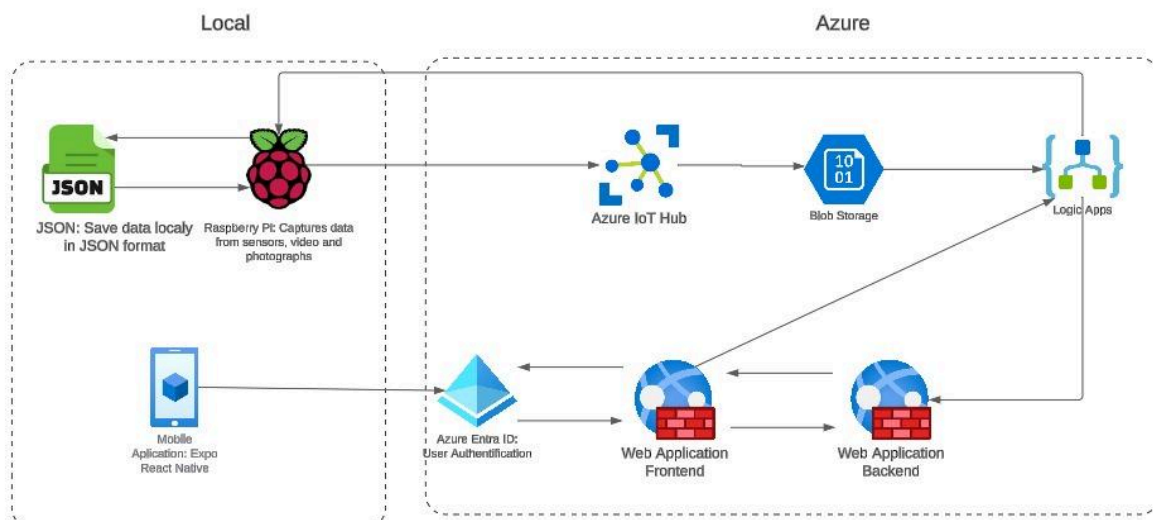
Architecture and Integrations Diagram

Image 5. Architecture and Integrations Diagram