

## IoT Use Cases

# 1.0 Precision farming

## 1.1 The Context

To be able to survive and thrive, especially in Africa, farms must exploit the true potential of the rich, fertile and virgin soils. They need to produce as much per acre as they can by using best practices in sustainable farming, effectively monitoring and reducing the risk of crop failure, minimizing operating costs, efficiently tapping and serving the broader global markets with a high-quality produce, and getting the true and fair value for its produce.

This requires, among other things, effectively managing asset and input resources like Land, Water, Fertilizers, Pesticides, Seed/Sapling quality and minimizing the impact of unpredictable variables (such as the weather and pests). However, achieving that objective is far from easy.

Conventional methods like physical crop inspection are time-consuming and can be inaccurate, while fixed and tractor-mounted sensors alone can't provide a real-time picture of what's happening in the field. Farmers/Farming companies face further challenges in translating this data into operational insights that can help them understand which actions to take, when and where. This is where there is a Comprehensive Farm Monitoring/Management system can help.

By generating detailed insights into the farm operations and the environment, a robust and integrated Farm Management System assists farmers in making data-supported operational decisions to optimize yield and boost revenue while minimizing expenses, chances of crop failure, and adverse environmental impact. Depending on the type of crop, this solution can help increase overall profitability per acre.

A "Precision Farming" revolution is already underway in the field of farming. Due to the advancements in technologies like GIS & Internet of Things (IoT), seemingly diverse universes such as a farmland and software can be brought together for precision farming. When it comes to farming, yield, productivity and cost of cultivation are as optimised as the decision a farmer can make with a given set of data/information on the field.

## Precision Farming Vision:

*“With direct access to vital parameters of farmland & by generating detailed insights, farming company can make real time Data-based operational decisions that will optimize yield and boost revenue while minimizing expenses and the chances of crop failure”*

The Precision farming vision sets out how IoT Based Farm Management may directly or indirectly enable Farming companies to optimize, increase agility and responsiveness, reduce operational costs and improve asset reliability.

The Precision Farming system aggregates granular, real-time data from a variety of sources, including environmental sensors in the field, NDVI images from UAVs (that show crop stress before it's visible to the naked eye), and sensors mounted on field equipment, weather forecast data, and soil databases. By combining telemetry from these different sources and leveraging a decision support engine encoded with crop-specific business rules, the proposed solution can provide practical recommended actions for farmers to take to improve their farms' economic output. The Precision farming solution can be connected to the farm's work management system, which enables the platform to automatically schedule the relevant machinery and people when the farmer accepts specific recommendations. Following are the typical use cases of Precision Farming system.

1. **Farm Land Mapping & preparation:** Nowadays, Drones are used to take accurate measurements much faster than a farmer can “walk the field”. Farms having large geographical area, the quantity of inputs, and hence the potential savings, are enormous. The growing conditions across a large farm area are quite variable (some plants may have deep, moist soil whilst other patches will be stony and dry; unwanted insects or fungus could have established colonies in one area but not in another; some plants will be tall while some seeds will not even have sprouted & so on.



2. **Land preparation, planting and field care.** These operations can be done using computerized machinery equipped with GPS and GIS; time is saved and soil and labour productivity improved. GPS and GIS also help work to be done in row resulting in precision within a few centimeters.

The use of autonomous tractor will increase productivity, improve quality and facilitate coverage of large tracts of the land. The tractor can be



programmed to carry out specific tasks and can also be operated remotely via a computer/tablet.

3. **Crop establishment:** GPS and GIS guide seeding so that exactly the right amount is distributed in each part of a field to achieve optimal plant establishment.
4. **Fertilizer application:** GPS, & GIS help farmers apply fertilizers on time, with the right amount for each soil type, thereby increasing yield. Use pesticides and herbicides only where needed, resulting in lower production costs and reduced environmental pollution.
5. **Irrigation:** Machinery and tools equipped with GPS and GIS ensure appropriate irrigation and drainage at the right time in the right place, resulting in water savings and reduced investment costs.
6. **Harvest:** Machinery and tools equipped with GPS, GIS and yield monitor help to harvest rice fast, safely and accurately, working also at night or in dirt; yield maps can be produced for future improvement.
7. **Post-harvest operations:** Advanced machinery and equipment increase the efficiency of post-harvest operations, resulting in high-quality rice, head rice and milling yield, and lower grain losses in processing and storage.
8. **Management:** A computer system can create and update information on soils, water, crops, insects, diseases and herbicides for improved future management. The potential to save money is huge, but more than this, healthier plants mean higher yields. It's a win-win situation: a money-saving, profit-boosting, tech-led way of farming that helps protect the environment.

The system can also be accommodated with features to calculate the economic impact of each recommendation so companies can immediately understand the financial implications of a particular course of action. This feature helps farmers make better real-time operational decisions based on economic measures versus continuing with inherited farming practices.

9. **Future Crop Management:** In addition, the solution shall allow farmers to review historical information on similar issues that may have been encountered so they can learn from the actions taken at that time and make better operational decisions today. One of the key features of the proposed solution shall be its user interface, which can be tailored to farmers' unique demographics.
10. Solution also provides an opportunity for more technologically proficient farmers to “dig behind the data” on which recommendations are based, for example, to take a closer look at NDVI or infrared images or telemetry data from a specific sensor in a certain part of the field. The Digital Agriculture Service can be used in a wide variety of ways to address inefficiency in farming operations across crop types. These range from reducing the time and improving the accuracy of scouting; to measuring growth rates; to providing input data to variable-rate application of pesticides and irrigation.

The service can be further “tuned” to learn from situations on a given farm to better tailor future recommendations. An example of a proposed solution use case would help farmer to decide when to harvest. For instance, the service can alert a farmer that a particular plot might be ready for harvest earlier than expected. Different harvest scenarios are presented—e.g., harvest 10 days early, five days early, or as currently scheduled—and the financial impact of each of these scenarios given expected crop market conditions at the time of harvest are clearly shown. Thus, the farmer can quickly see how each scenario would affect the farm’s profitability.

11. **End-to-end Integrated Farming Process:** Further, if the Precision Farming solution is integrated into a farm management system, the farmer can schedule the harvest from within the service, making the whole workflow seamless from insight, to decision, to execution. As the preceding examples show, farmers can use the proposed solution in many ways to increase their operating margin by boosting revenue, increasing operational efficiency, and reducing the cost of goods sold.

Taking advantage of the very latest technology of precision farming in crop protection and nutrition, using water more sustainably, and basing agronomic plans on hard data, sounds like a formula for success.

## 1.2 Precision Farming Objective & Benefits

Adoption of Precision Farming Vision would enable Eleven Green to actively manage its asset, adopt new Monitoring solutions and achieve more efficiency & productivity. Key strategic objectives of Precision Farming include:

- a) Improve Crop yield
- b) Provide information to make better management decisions
- c) Reduce chemical and fertilizer costs through more efficient application
- d) Provide more accurate farm records essential for sale and succession.
- e) Increase profit margin
- f) Reduce pollution through poor use of chemicals.

### Short-Term Benefits:

- Site specific information improves ability to diagnose crop production problems
- Increase farm production
- Yield restrictions caused by drainage, soil type, diseases, weeds can be identified & corrected
- Prevention of overlapping of inputs
- Promotes good land stewardship

### Long-Term Benefits:

- Data Collected & Analyzed
- Evolution of management practices
- Comparison of yield variations
- Evolution of crop inputs, new products

- Track trends & identify problems
  - Change in crop rotation & varieties
- Efficient equipment use
  - Increased field efficiency
    - Reduces overlaps & missed applications
  - Increased machinery utilization rate
    - Uses soil characteristics & weather to improve scheduling of operations
- Reduces Risks
  - Reduces variability in Net Returns

## About:

This document has been published by **Afriplains Digital**, in partnership with **FairEarth Consultants**.

This document should only be utilized as an information source to understand, at a broad level, how an integrated and comprehensive approach to utilizing IoT and Spatial Technologies can be useful for Farm Monitoring & Management.

**For More information on our IoT for Farming Solutions, please feel free to reach out to us by email on [info@afriplains.com](mailto:info@afriplains.com) , via phone on +255- 623859150 or via our digital & social media channels below:**

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