**Bayer Project Ideas**

* **Focus on climate change, sustainability, and crop recommendation.**
* **Climate Change – U.S. Carbon Program and Carbon Zero Commitment**
* **Our Path to Reducing Greenhouse Gas Emissions in Agriculture**
* **To tackle such an ambitious goal, we’re focusing our efforts where we can make the biggest impact, working collaboratively with growers and partners across the value chain to reduce the GHG emissions of crops grown in the field and even help farmers sequester CO2 and generate revenue from the practice, all**[**while also reducing emissions in our own operations**](https://www.media.bayer.com/baynews/baynews.nsf/id/2019-0318-e)**.**
* **How - By bringing innovations like more productive crops to the market, we can help growers produce more food on the same amount of land, with less impact on the environment—known as sustainable intensification.**
* **Solution Implementation:**
  + **Ensuring better soil management with tools and practices such as:**
    - **No-till farming: by not tilling the soil, soil health improves, allowing it to better store carbon, nutrients, and water; and by not disturbing the soil, the carbon captured remains in the ground.**
    - **Crop protection: Crop protection technologies, including biologics, are important to preserving and enhancing yield potential of crops and help the implementation of climate-smart practices such as no-till farming or cover crops.**
    - **Breeding technology: innovative crop genetics require less inputs like fertilizer and crop protection agents and allow growers to pursue no- and low-till farming.**
  + **Enabling precision application of inputs including:**
    - **Digital tools: data-driven tools ensure proper seed placement and that the right number of fertilizers and crop protection is applied in the right place at the right time, preventing over-fertilization while also requiring fewer tractor passes in the field.**
    - **Water use: precision irrigation systems improve energy use and reduce the amount of water used on crops.**
  + **Equipping and rewarding growers to capture carbon from the atmosphere with solutions such as**
    - **Cover crops: selected crops planted off season in fields maximize the amount of carbon that stays in the soil, preventing it from being released into the atmosphere while also enriching with nutrients potentially reducing the need for fertilizer.**
    - **Dry seeding of rice: a technique that reduces methane emissions from flooded rice paddies.**
    - **Bayer Carbon Initiative: already launched in the U.S. and Brazil, this innovative, science-based, and collaborative pilot program helps growers generate revenue for adopting specific climate-smart practices--such as no-till farming and the use of cover crops.**

**Current affairs**

* + **Bayer Unveils Groundbreaking Solar Energy Projects at sites in New Jersey and California**
    - **WHIPPANY, NJ and WOODLAND, CA – Jan. 23, 2024 – A new solar array installation at Bayer’s vegetable research and development site in Woodland, CA will provide 70% of the site’s electrical energy demand.**
    - **“With this new installation, the Woodland site is the most onsite solar-powered operation within Bayer globally,” says Enrique Wehlen, Head of Sustainability, Safety, Health & Environments (SSHE) North America at Bayer.**
    - **The Woodland solar power project follows a recently completed solar installation at Bayer’s main U.S. offices in Whippany, NJ. The two new solar energy projects, each designed to reduce energy costs while promoting sustainability, will be unveiled today to employees and community leaders at local events.**
    - **Both projects align with Bayer’s sustainability commitments to reach carbon neutrality by 2030 and to have net-zero waste across its entire value chain by 2050. A key strategy to achieving Bayer’s reduction targets, which have been approved by the Science Based Targets initiative, is to purchase 100% sustainable renewable electricity by 2030. Bayer has put a large focus on leveraging energy efficiency and clean energy resources to achieve its robust, science-based sustainability targets.**
    - **In accordance with the United Nations Sustainable Development Goals and the Paris Agreement to limit global warming to 1.5 degrees Celsius, Bayer aims to continuously reduce GHG emissions within the company and along its entire value chain.**
    - **Employees serve the community through active volunteer participation with local non-profit organizations as well as welcome students from surrounding schools to experience hands-on learning in the newly opened Baylab, a STEM education center.**
  + **Improved FieldView Experience In 2024 Includes New Connectivity Option with Precision Planting**
    - **This includes enhanced capabilities in FieldView Plus, more robust, and personalized features available through the new FieldView Premium subscription tier, as well as improvements to FieldView’s in-cab experience.**
    - **Precision Planting announced today that FieldView customers can now seamlessly transfer agronomic and farm equipment data from Panorama™ to their FieldView accounts. The new Panorama app and website connects to a farmer’s Gen 3 20|20 to easily view maps, input summaries, and agronomic data on a smartphone, tablet, or computer. Testing took place throughout the 2023 season, and FieldView is one of the first platforms with the ability to receive data from Panorama, when a farmer chooses to make the connection.**

**Farms of the future**

**Illinois**

* **Restore soil health and perform carbon sequestration.**
* **Preceon smart corn. Make recommendations according to farmer’s field and local area. Provide information on risk vs yield and expected yield.**
* **Purchase planning of seeds/traits and crop protection products using Microsoft Azure tools and connection between Bank, Retail, and Insurance.**
* **Uses outcome-based pricing, system of products comes with predicted yield and plan for how to make it happen. All tools are available in one place.**
* **Seeds are planted by equipment which receives a digital script based on the nature of the farm and optimally sows seeds, with adequate spacing.**
* **Corn-rootworm technology contains Nitrogen fixing microbes, making it usable for the crops.**
* **Genetically modified crops - Perform SWOT analysis for each crop to identify environmental factors causing loss of yield.**
* **Harvesting – Carbon credit revenue for regenerative agricultural practices.**
* **Summer – Corn and harvest in Fall, Winter - CoverCress and harvest in Spring. Can be used as fuel for aviation industry. Summer – Soybean.**
* **Prescriptive season long plan – Multi Season Crop Planner – Helps identify crops for planting.**
* **Herbicide tolerant soybean – No till system, promoting carbon sequestration. Regenerative agriculture practices**

**India**

* **Direct seeded rice – Produce more food with limited water supply.**
* **Use a rice seed machine to plant seeds in two hours or use a drone. Latest precision bred Arize hybrid seed designed for direct seeding.**
* **Uses oxadiazon as pre-emergent before weeds sprout and next gen post-emergent herbicide, which doesn’t impact rice seeds.**

**Spain**

* **Aims to grow next gen tomatoes.**
* **Uses Serenade fungicide to enhance root development and suppress Fusarium in the soil.**
* **There is no effective fungicide or other cure for Fusarium wilt. The pathogen nearly always kills infected hosts. Prevention and exclusion are the only effective management strategies. Avoid this problem by replanting at that site using species from different genera than plants previously infected there by Fusarium.**
* **Bayer nematool - Decide between Bio Act and Velum Prime to control Nematode.**
* **ResiYou tool – Plan pesticide residue standards of customers.**

**Brazil**

* **Soy and Corn planted in the same year.**
* **Orbia – Digital tool for recommending supporting crop protection. Try new varieties of plants, in part of field dryer than the other areas, which are drought and herbicide resistant.**
* **Also get intel about diseases and deploy the required fungicide to take care of it.**
* **Save cost and fuel using precision application practices to apply fungicide only to affected areas. Get agronomic recommendations through science-based assessments, having low carbon footprint, leading to sustained production of cost over time.**

**In general, the focus is on regenerative farming, using digital products to analyze farmlands, identify diseases, practice precision farming, and create disease resistant/herbicide resistant seeds.**

1. **What about adoptability/affordability/who is the primary consumer?**
   1. **Eg: Indian rice farmer, going from traditional to this method.**
2. **Are seeds produced region specific? Soil and**
3. **To be disease resistant, is there a mapping for each crop vs disease encountered?**

**Boosting Agriculture Yields with Enhanced Recommendations (BAYER)**

**Task 1 – Soil moisture requirement for a specific crop - Prediction: Data issue**

**Link 1 -** [**https://dl.acm.org/doi/fullHtml/10.1145/3440840.3440854#:~:text=Some%20of%20the%20commonly%20used,predict%20the%20soil%20moisture%20behaviour**](https://dl.acm.org/doi/fullHtml/10.1145/3440840.3440854#:~:text=Some%20of%20the%20commonly%20used,predict%20the%20soil%20moisture%20behaviour)**.**

**Link 2 –**

[**https://www.kaggle.com/datasets/sathyanarayanrao89/soil-moisture-data-from-field-scale-sensor-network/code**](https://www.kaggle.com/datasets/sathyanarayanrao89/soil-moisture-data-from-field-scale-sensor-network/code)

**Most important link**

[**https://github.com/topics/smart-irrigation**](https://github.com/topics/smart-irrigation)

[**https://github.com/lukefire5156/SMART-IRRIGATION-USING-ARTIFICIAL-INTELLIGENCE-AND-IOT/blob/master/PROJECT%20REPORT.pdf**](https://github.com/lukefire5156/SMART-IRRIGATION-USING-ARTIFICIAL-INTELLIGENCE-AND-IOT/blob/master/PROJECT%20REPORT.pdf)

**A screenshot of a math test

Description automatically generated**

* **The psychrometric constant (γ is approximately) 0.066 kPa/°C**
* **Δ (slope vapor pressure curve), Rn (net radiation), and G(soil heat flux density) to be calculated from image below:**
* **Source of data -** [**https://openweathermap.org/api**](https://openweathermap.org/api) **and** [**https://www.weatherbit.io/api/weather-current**](https://www.weatherbit.io/api/weather-current)
* **es and ea can be computed from the APIs**

**A screenshot of a computer

Description automatically generated**

**A math equations and formulas

Description automatically generated with medium confidence**

* **Td is the dew temperature and T is the air temperature – from API.**

**Task 2 – CO2/GHG emissions – Temperature/Precipitation analysis - Dashboard**

[**https://www.kaggle.com/datasets/alessandrolobello/agri-food-co2-emission-dataset-forecasting-ml/data**](https://www.kaggle.com/datasets/alessandrolobello/agri-food-co2-emission-dataset-forecasting-ml/data)

**Task 3 – Crop Recommendation: Multi-class classification**

**Aim – For certain crops: Rice, Wheat, Corn, Soybean, predict yield and diseases encountered.**

**Dataset -**

**Agriculture Market Analysis**

* **Cost for different commodities expected to increase:**

1. [**https://www.agriculture.senate.gov/newsroom/minority-blog/usda-says-high-farm-production-costs-not-easing-in-2024**](https://www.agriculture.senate.gov/newsroom/minority-blog/usda-says-high-farm-production-costs-not-easing-in-2024) **- Salient features:**
   1. **USDA’s first 2024 cost-of-production forecast for major field crops such as corn, soybeans, wheat, cotton, rice, and peanuts, among others, reveals that input costs are expected to remain elevated into the next growing season, at the third-highest level of all-time, and only slightly lower than the record-high reached in 2022.**
   2. **While some input cost categories like fertilizer and chemical expenses are projected to decline from 2023 to 2024, other expenses such as seed costs, labor, machinery and equipment, taxes, and insurance are expected to increase.**
   3. **Based on USDA’s current input cost projections, trend yields, and commodity price trends, several major field crops may experience marketing year average prices below breakeven levels this year and possibly into 2024.**
   4. **Declining crop prices and elevated input costs highlight the importance of farm management factors such as risk management, marketing, diversification, and production efficiency that can enhance income and reduce costs – and possibly contribute to more favorable or above-breakeven margins for major field crops.**
2. [**https://www.agriculture.senate.gov/newsroom/minority-blog/revisiting-farm-production-expenses**](https://www.agriculture.senate.gov/newsroom/minority-blog/revisiting-farm-production-expenses)

**Weather Prediction – Data Collection Flowchart**

Loop through the data to obtain latitude and longitude for each city.

Use REST APIs to get data from Weatherbit and OpenWeather

Write batch process to automate the data collection process.

Insert the data into the SQLite database.

Process the API response(deserialize) and wrangle, to get the features of interest.

**Crop Recommendation – Predictive model & deployment flowchart**

Perform Exploratory Data Analysis and data preprocessing.

Make real-time predictions

Deploy model using Flask API

Dump model and label encoder as pickle files.

Best model – Random Forest

Metrics used – Accuracy, Precision-Recall (Balanced target)

Build classifiers and evaluate model.

Split dataset into training and test sets