Precision Farming Based on Data Analytics

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Abstract- *The agriculture industry plays an important role in the needs of humankind. The rising of the world population, as well as the decrease in the number of workers in the agricultural sector, calls for an increased demand for food suppliers. In this paper, we propose a novel agricultural robot based on CNC machine and a data analytics driven platform for farming crops autonomously without any human intervention. What differentiates our project from other farming platforms is the ability to carrying out the farming process from seeding to the harvesting of crops and everything can be controlled. Large datasets including every aspect of all unique varieties of plants are gathered to provide precision farming and get the best yield from every crop without any pesticides and chemical fertilizers.*

Keywords- Agriculture 4.0, precision farming, CNC based agriculture, data analytics in agriculture.

I. INTRODUCTION

A number of global trends are influencing food security, poverty, and the overall sustainability of food and agricultural systems. The four main developments placing pressure on agriculture to meeting the demands of the future: demographics, scarcity of natural resources, climate change, and food waste.

- Increase in demographics will boost food demand.
- Natural resources are highly stressed.
- Climate change is reducing productivity in agriculture.
- Food waste and environmental threat.

Outcome of all the above is poverty and hunger.

According to this journal the solution for above outcomes are:

Agriculture 4.0: Agriculture 4.0 is a term for the next big trends facing the industry, including a greater focus on precision agriculture, the internet of things (IoT) and the use of big data to drive greater business efficiencies in the face of rising populations and climate change.

Precision Agriculture: Precision agriculture (PA) is an approach to farm management that uses information technology (IT) to ensure that crops and soil receive exactly what they need for optimum health and productivity. The goal of PA is to ensure profitability, sustainability and protection of the environment.

CNC based hardware setup: This is a plantation setup with 3 axis movement (x,y,z). It has a rail setup in the base in which the frame or is placed. This helps the frame to move front and back (y axis). A gantry is fixed connecting the two ends of the frame. This gantry can move up and down along the frame (z axis). There is a slider planed on the gantry which can move left and right along the gantry (X axis). The slider has a connecter and a camera for equipment which is used for watering, weeding, and monitoring the plants.

Data Analytics: Agriculture is becoming increasingly information and knowledge centric today. Due to the large rural population, agriculture plays a vital role in Indian economy. In the current scenario, a large number of data is generated from various sources like weather, climate, geo-spatial, crop production, consumed by stakeholders, location specific crop disease in farm practice. But it is not used effectively and optimally by the experts due to lack of information flow. Thus, to bridge the gap between users and information, data analytics can be one of the solution.

II. LITERATURE SURVEY

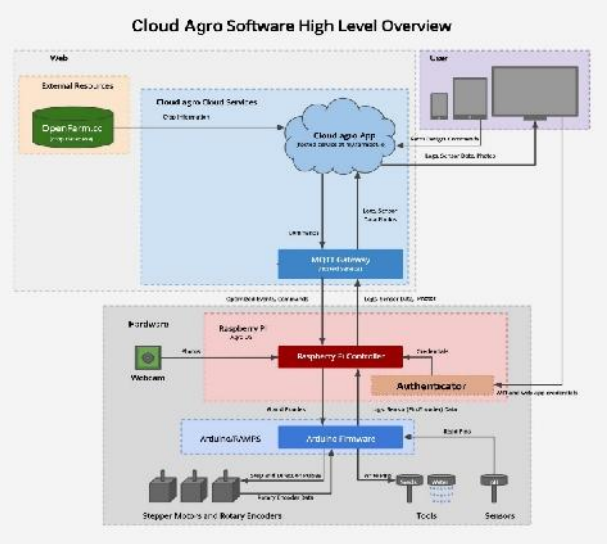
Title: Evaluation of random forest method for agricultural crop classification.
Author: Asli Ozdarici Ok1 , Ozlem Akar2 and Oguz Gungor.
Year: 2017
Abstract: This study aims to examine the performance of Random Forest (RF) and Maximum Likelihood Classification (MLC) method to crop classification through pixel-based and parcel-based approaches. Analyses are performed on multispectral SPOT 5 image. First, the SPOT 5 image is classified using the classification methods in pixel-based manner. Next, the produced thematic maps are overlaid with the original agricultural parcels and the frequencies of the pixels within the parcels are computed. Then, the majority of the pixels are assigned as class label to the parcels. Results indicate that the overall accuracies of the parcel-based approach computed for the Random Forest method is 85.89%,

which is about 8% better than the corresponding result of MLC.

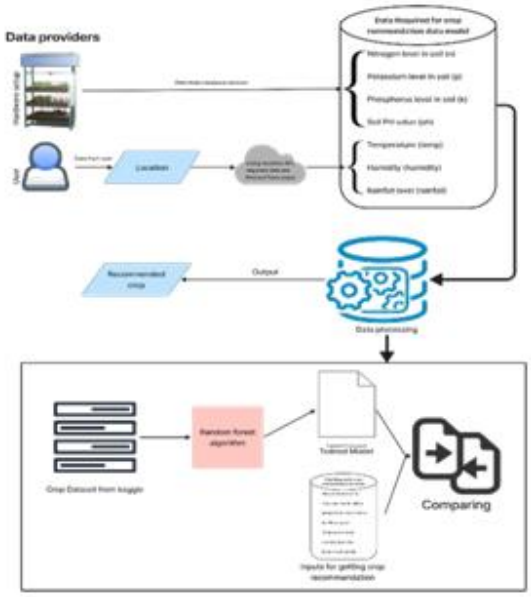
Title: Applying Naive Bayes Data Mining Technique for Classification of Agricultural Land Soils.
Author: Surili Agarwal, Neha Bhangale, Kameya Dhanure, Shreeya Gavhane.
Year: 2018
Abstract: Naive Bayes classifier is a term in Bayesian statistics dealing with a simple probabilistic classifier based on applying Bayes' theorem with strong (naive) independence assumptions. A more descriptive term for the underlying probability model would be "independent feature model".

Title: Measuring performance in precision agriculture: CART—A decision tree approach.
Author:T.Waheed, R.B.Bonnell
Year: 2006
Abstract: Recently, there have been very rapid developments in hyperspectral remote sensing and interest is fast growing in the applications of hyperspectral data to precision farming. This paper investigates the potential of hyperspectral remote sensing data for providing better crop management information for use in precision farming by using an artificial intelligence (AI) approach.

III. SYSTEM ARCHITECTURE



IV. DATA PROCESSING



Data fetched from user:

We get the location data of the grid space that the user purchased, from which the following data are fetched using third party weather API.

1. Temperature
2. Humidity
3. Rainfall level

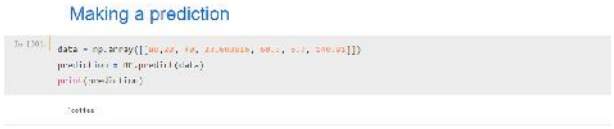
Data fetched from Hardware setup:

1. Nitrogen level in soil
2. Potassium level in soil
3. Phosphorus level in soil
4. Soil PH value

After retrieving the necessary information, it will be processed to suggest a plant that can be planted in the user-purchased grid area.

V. RESULT

The below image in one of the outputs. Where, by using the Random Forest Classification algorithm, a trained data model is created for the downloaded dataset. This data model is compared with the input that is fetched from the user and the CNC hardware setup to recommend a suitable crop that can be planted in the respective grid space for higher yields.



VI. CONCLUSION

Our system of decentralized agriculture is a self-sustaining automation model correlating to the obvious future of agriculture evolution – The Agriculture 2.0. Cloud agro is a agri-tech concept unlike the other inventions. This system can provide a better and healthy food industry and promotes agriculture to everyone. The grid system is capable of handling many varieties of plants and get the best yield from every plant. Data driven analytics helps users to determine what to grow and how to grow. The application is made intuitive and provides 24/7 support for users. The efficacy of bringing agriculture to their phone is making it extremely simple for the users to be a part of this upcoming internet of agriculture.

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