Framework of Precision Farming: A Review

Abstract

Precision Farming is the new age technology, one should adopt to boost the process of farming and receive better output. Here, A Framework is proposed for obtaining the desired standard quality of the crop providing all the required conditions to achieve this. Some Parameters related to soil, environment can be considered to observe the crops for their well-being and to check the original status of the crop. Using IoT device, with in-built sensors to detect soil moisture and its nutrients, environmental parameters such as temperature and humidity, data goes to Cloud Server for further processing by running algorithms. Here, a deep review is presented so as to gain the insight in the technologies being adapted till now for the betterment of the agriculture

Key words: Precision Farming, IoT device, sensors, Cloud Server.

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I. Introduction

For understanding the framework for precision agriculture that we intend to create, we need a thorough understanding of what is agriculture. What was the need for bringing Precision Agriculture? What are the technologies in trend that can be utilized together with Precision Agriculture to make it fruitful for farmers?

A. Farming

Husbandry is growing crops and keeping creatures for food and raw accoutrements. In other words, we can say that farming is a bit smaller part of agriculture.

Agriculture [28] is the art and wisdom of cultivating the soil, growing crops and raising beast. it includes the medication of factory and beast products for people to use and their distribution to requests. Traditionally, growers have used a variety of styles to cover their crops from pests and conditions. they've put condiment- grounded venoms on crops, culled insects off shops, bred strong kinds of crops, and rotated crops to control insects.

Farming styles frequently vary extensively around the world, depending on climate, terrain, traditions, and available technology. low-technology husbandry involves endless crops food grown on land that isn't seeded after each crop. Advanced- technology husbandry involves crop gyration, which requires knowledge of farmable land. Scholars and masterminds not only use crop gyration and irrigation, but factory crops according to the season, type of soil, and quantum of water demanded.

There are lot of challenges in the way of farming. Biggest challenge is overpopulation. The natural, common, and traditional agricultural practices in developed and developing countries have led to the damage of the precious topsoil, water, and other resources. This has brought the situation for many countries to think about replanting forests.

There is a need for upgradation of traditional farming methods so as to make proper use of the limited resources, fulfilling the increasing demands of food and that too with sustainable environment. It is where Precision farming comes into picture

B. Precision Farming

There are three processes in this farm management concept that are mainly to observe to estimate and to respond to various inside and outside field variability inputs for smart agriculture [39].

Precision tech farming is a management concept that collects, processes and analyses time, space and individual data and combines them with other data to support management decisions based on different predictions to improve resource and production utilization, quality, profitability and safety in agriculture.

New technologies such as geospatial technology, Internet of Things (IoT), big data analytics and artificial intelligence (AI) can be used to make management decisions to improve crops. Precision agriculture (PA) requires the use of various technologies to improve agricultural equipment in order to increase agricultural yields and reduce input losses. [13] Precision agriculture is defined by many terms in the literature, such as precision agriculture (PF), specific field application (SSA), special farm and differential treatment (VRT). These terms will be used together below. The broad scope of smart agriculture also includes technological advances such as self-management, agricultural management, and self-management such as agricultural robots. Precision agriculture integrates information and communication technology into machines, products and sensor systems used in agricultural production. Technologies such as the Internet of Things and cloud computing have further supported this development by bringing more robotics and intelligence to agriculture [40]. For example, farmers can use smartphones and tablets to access real-time information on all crops. Everything related to daily activities such as terrain, vegetation, terrain, weather, space, property, animals, resource use.

C. Internet of Things

Internet of Things (IoT) is the way of connecting devices through internet. It helps in establishing connections between devices may be of different architectures. IoT encourages cyber systems to be more strong with the concept of bringing them closer using some latest technologies together. For there types of connections between devices we humans are not

needed to have interference with objects. But yes of course it brings challenges also that too with energy conditions, security, big data etc.

IoT workshop [29] with colourful enabling and (AI), big data and analytics, etc. At the heart of IoT is WSNs, conforming of detectors stationed in a seeing area to cover specific miracle (similar as environmental monitoring) and collect data. likewise, indeed more pervasive network configuration are being developed where all possible bias (substantially of miscellaneous nature) connect with each other to smell, gather and dissect data of different nature to act upon the intelligence gained from deep perceptivity of the data. These conduct are substantially without mortal commerce.

The results from IoT Total Addressable Market (TAM) reveal that the number of IoT-connected bias in the overall world will grow from7.6 billion to24.1 billion and will lead to the profit tripling from USD 465 billion to over USD1.5 trillion [1]. IEEE explains IoT as a network that connects uniquely identifiable effects to the Internet. The effects have seeing actuation and implicit programmability capabilities ''. IoT basically uses connected bias to perform a group of tasks like process monitoring, environmental seeing, and health monitoring. Wireless Sensor Network (WSN) are the most pivotal underpinning technology for IoT. A WSN is a network formed by planting detectors to collect and further the data to the enterprise or pall for farther processing. This precise data from the detectors, upstanding bias, and IoT results are used for adding ranch productivity with environmental sustainability, prognosticating climate change, monitoring, and having a visionary response to crop performance. It also helps in choosing a suitable crop by observing and measuring the demand or dependent factors.

II. Literature Review

In [1], a design of a multidisciplinary agriculture solution model for Precision Agriculture AgriFusion combining emerging technologies like Learning by Machine (ML) and Artificially Intelligent system (AI), edge computing and other emerging technologies is proposed. With the use of Blockchain and IoT, a trusted food traceability system is presented [4]. Blockchain is used for security reasons for proposed Blockchain based Producer-Consumer Model (BPCM)[5]. Blockchain and IoT together analyse agricultural data. The survey shows that the duo helps in Precision agriculture smart apps[6]. An agricultural architecture based on green IoT with smart agriculture is being described. Usage of technologies is also highlighted[7]. A generalized Blockchain security architecture is proposed[8]. [9] presents supply chain architecture using IoT and Blockchain detailed with concerns and security threats of the existing system. [10], [11],[17] details about UAV applications in crop monitoring process and data acquisition and technologies are discussed.

In [12], a differently formed framework named as AgriLoRa for modern agriculture is proposed for low budget farmers with wireless sensor network cloud servers to run the algorithms. [13] gives a survey on vegetation indices and their latest use in Precision agriculture, covering studies between 2015 to 2020. [14] summarizes agriculture related UAS applications. Also discussed the AFarCloud project from Europe. AI and Big Data applications made familiar in Precision Agriculture [15]. [16] Analyses how to accurately place the sensors in the field and the height of the drone to catch the data.

Here is some mention about very vast area of Machine Learning and its applications in the field of agriculture with respect to prediction of soil parameters, prediction of crop well-

being, and detection of weed in crops and species [19]. A DL framework AgriSegNet for automatic detection of problems in farm is proposed to boost Precision Agriculture Potency.

A fair description of web of stuffs, wireless seeing element networks, knowledge analytics and machine literacy in husbandry [23]. In[24], IoT- grounded sensible husbandry observation model is planned for parcels like Temperature, Rain Wind, Acoustic, pH situations of the cornfields, moisture, position and Chemical for sensible husbandry operations. The experimenter invents a brand-new model of high- performance- grounded edge computing, jointly useful in provident offloading of knowledge with voguish work inflow enhancement [25]. A low- power bedded system with a Neural Accelerator suitable to capture and reuse images and machine literacy functionalities worked towards nonstop pest infestation inside fruit vineyards[30]. A case study regarding computer vision for marketable drones studies openings and challenges [32]. The Experimenter presented a comprehensive check on the rearmost developments of perfection husbandry with UAV RS and edge intelligence and concluded edge intelligence as the confluence of artificial intelligence and edge computing [33]. An bedded seeing system amended with the AI is presented, icing the nonstop analysis and in situ vaticination of the growth dynamics of factory leaves [34]. A methodical review that aims to identify the connection of computer vision in perfection husbandry for the product of the five most produced grains in the world sludge, rice, wheat, soybean, and barley. The Authors also used advanced AI ways Deep belief network for the timber of new styles [35].

III. Comparison

A thorough study of the research papers related to precision farming is performed. There are several technologies that have been adapted for the purpose of the improvement of the agriculture. There is a vast number of combinations that have been reviewed and applied and then analysed for their performances. A comparative study is presented in the form of table.

Table 1: Comparison between different technologies used or reviewed in research papers.

Research Papers	AI	Big Data	ML	Computer Vision	SDN	Edge Computing	Block Chain	Nano Tech	Remote Sensing	Energy Harvesting	WSN	Cloud Edge Fog Computing	IoT Architectures Equipments	PA Simulators	Vegetation indices	Data/ Knowledge Analytics
[1]	√		√	√	√	√	√	√	√	√	√	√	√	√		
[2]													√			
[3]							√									
[4]							√									
[5]							√						√			
[6]							√									
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[14]																
[15]	√	√							√				√			
[16]											√		√			
[17]													√			
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[19]		√	√								√					
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[23]		√							√							√
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[25]					√		√									
[26]						√	√		√	√						
[27]																
[28]					√											
[29]	√	√			√											
[30]		√					√									
[31]	√	√			√											
[32]	√		√	√	√											
[33]	√				√		√									
[34]	√						√									
[35]	√	√	√	√												
[36]	√															
[37]	√				√											

IV. Conclusion

Extreme Research is done to uplift the status of farming being executed all over the world. All the emerging technologies play vital role in the improvement of agriculture. To make it more efficient, productive, with the goodness of sustainable environment we need to adapt with the new techniques. Precision Farming is something which is inevitable these days. Some significant technologies to be used for PA are AI, ML, Edge Computing, IoT, WSN. Based on these, one can easily achieve the goals of precision farming.

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