Journal of Advanced Research in Instrumentation and Control Engineering
Volume 8, Issue 1&2 - 2021, Pg. No. 22-26
Peer Reviewed Journal

Article

Smart Technology in Farming

Laxman Reddy[1], Shyamji Tiwari[2]

[1,2]Research Scholar, Master of Computer Applications, Thakur Institute of Management Studies, Career Development & Research (TIMSCDR), Mumbai, Maharashtra, India.

I N F O

Corresponding Author:
Laxman Reddy, Master of Computer Applications, Thakur Institute of Management Studies, Career Development & Research (TIMSCDR), Mumbai, Maharashtra, India.
E-mail Id:
manreddy462@gmail.com
How to cite this article:
Reddy L, Tiwari S. Smart Technology in Farming. *J Adv Res Instru Control Engg* 2021; 8(1&2): 22-26.

Date of Submission: 2021-04-17
Date of Acceptance: 2021-05-04

A B S T R A C T

Manageable advancement is of developing significance to the agribusiness area on the grounds that the current lacking use of assets and energy utilization, along with the contamination created from poisonous synthetic substances, cannot proceed at present rates. Supportability in agribusiness can be accomplished through utilizing less (or no) toxic synthetic substances, saving normal assets, and lessening ozone depleting substance outflows. Innovation applications could assistranchers with utilizing legitimate information in dynamic, which prompts low-input horticulture. This work centers around the job of brilliant innovation usage in maintainable agribusiness. The impacts of keen innovation execution are breaking down by utilizing a contextual analysis approach. The outcomes show that the plant production line utilizing knowledge innovation improves support ability execution by expanding creation efficiency, item quality, cropevery year, asset use proficiency and sanitation, just as improving representatives' quality oflife.

Keywords: Shrewd Advances, Maintainable Agribusiness, Plant Processing Plant Introduction

Introduction

In the period of the fourth modern upset (Industry 4.0), new advances, for example, fake insight, robotization frameworks, and distributedcomputing have been created to join the computerized what is more, actual world together. One of the Industry 4.0 advantages is to give an intersection workspace among machines, foundations and advancedstages.[1] The techniques for Industry 4.0 have been examined in the territory of horticulture. Different advancements, like sensor innovation, AI, remote correspondence, situating frameworks, and information perception devices, have beene mbraced to make worth and increment profitability in the cultivating area.[2] Because of the natural weight on water short ages, deficient land use, soil exhaustion, further more, ozone harming substance discharges, the requests on economical agribusiness are quickly expanding. The practical turn of events (SD) idea was created with respect to a rearrangement of an undermined future. Numerous areas face dangers of inescapable harm to the human climate.

Natural stress has been viewed as the consequence of the expanding development of the populace, innovation development and advancement and the rising expectations for every day comforts among the rich. Given the significance of agribusiness as the pivotal supplier of food, the economic advancement of this area is significant. Subsequently, manageable horticulture needs an inventive framework that secures and improves the regularassetbase while expanding profitability. The formatter will need to create these components, incorporating the applicable criteria that follow. There are fundamental exploration works that manage parts of the innovation execution for supportable farming. The creators of[3] Reviewed significant examination deals with shrewd farming data dealing with strategies. The innovative applications identified with farming perspectives were characterized into three classes, specifically information sources and assortment, AI (ML) approaches for farming information and keen information procurement. These applications lead to the advancement of development for accuracy and ideal cultivating. The creators of[4] examined

fake gadgets of shutplant creation framework sand found that shrewd plant creation frame works produce great plants and transfers with least utilization of assetsand carbon dioxide emanations as well as natural contaminations.

This work plans to examine the impacts of shrewd innovation usage on maintain ability execution by utilizing a contextual analysis. The contextual investigation organization, to be specific the Wangree Health Factory Organization (situated in Nakhon Nayok, Thailand), conveys plant production line with counterfeit lighting innovation to develop new natural vegetables and organic products. This work builds up the investigation structure to dissect how sending plant production lines will affect the maintain ability of agribusiness. This article is coordinated as follows: first, the writing audit gives a foundation on shrewd cultivating and economical horticulture.

At that point, the material and techniques area give an exploration system and contextual investigation examination and is followed by the outcomes segment. At last, the parts of brilliant innovationare introduced andexamined.

Literatu Rereview

Smart Farming

Brilliant cultivating is an administration idea utilizing present day innovation to expand the amount and nature of horticultural items. Savvy cultivating includes a mix of data and correspondence innovations into machines, sensors, actuators and organization gear for use in farming creation frameworks.[5] There are a few advances identified with keen cultivating, including sensors, mechanical technology, the Internet of Things(IoT), planning, dynamic and measurable cycles.[5,6] Beam[6] proposed the itemized structure of IoT-based farming. This structure in volves six layers. To begin with, the actual layer contains different kinds of gadgets, for example, sensors and microcontrollers, to gather, trade, and cycle information to different gadgets. Second, the organization layer includes the Internet and significant correspondence advances. Third, the IoT-based middleware layer performs different undertakings, for example, gadget the executives, interoperation, setting mind fulness, stage portability, and security-related errands. Fourth, the help layer gives distributed storage and Software-as- a-Service (SaaS). Fifth, the examination layer performs enormous information handling to prescient and multi culture analysis. Sixth, the client experience layer encourages the rancher's correspondence utilizing interpersonal organization exercises to share and scatter farming information.

Plant factories are one of the smart farming applications. A plant factory is a closed-growing system that enables a farmer to achieve constant and regular production of vegetables throughout the year. There are three types of plant factories: (1) Plant factory with sunlight; (2) Plant factory within sunlight and supplemental light; and (3) Plant factory with artificial lighting. The plant factory with artificial lighting replace sunlight with artificial intelligence sources of light. This plant factory creates a more consistent light environment for the plants. Ray[6] explained that there are three units for managing plant factory systems: (1) Farm Gate Way (FGW), (2) A data collection/ storage/ distribution platform, and (3) an application module. A FGW unit is a data collection and control device. It collects growing conditions data in the plant factory (such as temperature and nutrient content) and the crop production equipment data (such as nutrient solution pumps and heat pumps). A cloud-based data collection, storage, and distribution platform isused to provide communication between the data center and the plant factory for the control of growing conditions and equipment. It also helps in the servicing of command-and-control information management. The application unit is composed of physical devices to perform three operations: sensory data reception, command delivery to the FGW, and response reception from the FGW.

Material and Methods

Research Framework

A framework to analyze the roles of smart technology unsustainable agriculture consists off our steps. (Figure 1).

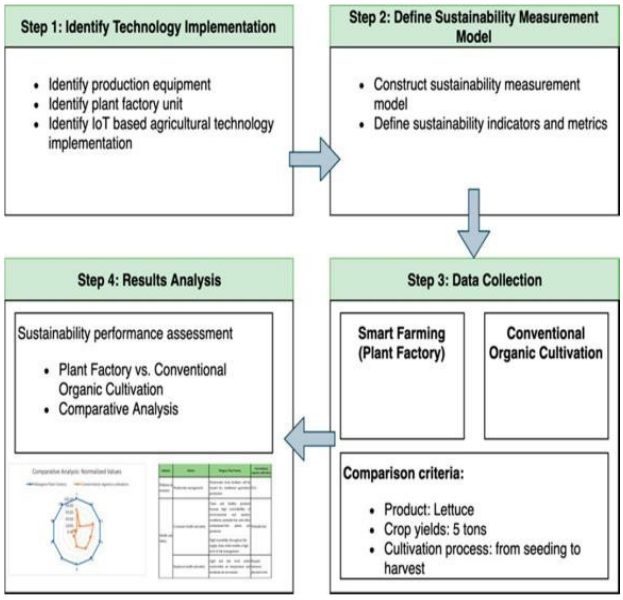

Figure 1.A framework to analyze the roles of samrat technologies sustainable agriculture consists of four steps

Stage 1: Identify innovation usage of the contextual analysis by utilizing the IoT-based agribusiness and plant production line unit system.[6]

Stage 2: Define a supportability estimation model by characterizing manageability pointers and measurements and building the estimation model.

Stage 3: Planting information was gathered by utilizing the contextual analysis. The information on development in a plant production line were gathered from Wangree Health Factory Company. The information on ordinary natural development were gathered from Wangree Organic Farm. The applicable information was gathered dependent on the presumption of equivalent creation yields, which is one-crop development of 5 tons of item weight. This information assortment incorporates all exercises from cultivating to gather measure.

Stage 4: Assess the maintainability execution of plant industrial facility development contrastedwith ordinary natural development.

Case Study Overview

Wangree Health Factory Company, situated in Nakhon Nayok, Thailand, was established in 2016 with the corporate vision of utilizing current computerized innovation to give new natural vegetables and organic products to the Thai market. A plant manufacturing plant with man-made consciousness light is an indoor cultivating framework associated with a savvy control framework. The constructions of the plant manufacturing plant separate the plants from the outside climate, so the plants are shielded from dubious conditions. These frameworks grant high- caliber and high return creation all year under a controlled climate (e.g., light, temperature, moistness, the centralization of carbon dioxide, and culture arrangement). The IoT-based innovations permit ranchers to design their creation by utilizing cell phones for observing and controlling their cultivating frameworks.

Wangree Health Factory Company joins a vertical cultivating framework with IoT innovations (Figures 2 and 3). The development cycle is completely mechanized for watering, lighting, supplement adding and temperature controlling. The 173.85m 2×6m high plant processing plant delivers around 50,552 heads of lettuce for each month. The principal creation hardware is made from power supply, a cooling framework, supplement arrangement supply, lighting, CO^2 supply, shrewd gadgets and specialized gadgets.

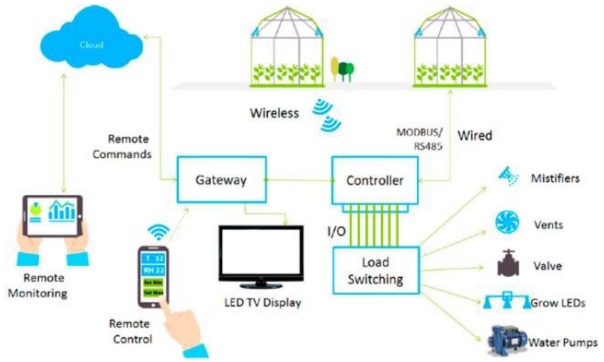

Figure 3.Wangree Plant Factory IoT-based innovation

Wangree Plant Factory utilizes IoT-based innovation to create and deal with the agribusiness creation framework. The work process of the framework comprises of three stages (1) Detecting and gathering information from sensor gadgets; (2) Analysis and control dependent on a particular AI calculation; and (3) Data perception for factual answering to help ranch proprietors decide. (Figure 2)

This work receives the maintain ability execution estimation model proposed by19 (Figure 3). The target of the proposed model is to quantify the maintain ability execution of economical cultivating. This model is made from five levels.

Level 0 is the high level and recognizes the objective, which is reasonable farming.

Level 1 is a measurement level partitioning manageability into financial, natural, and social classifications.

Level 2 is a sub-measurement level. There are eight sub-measurements with respect to three chief measurements. For instance, crude material, regular assets, and energy are sub-measurements of the natural viewpoint.

Level 3 is a marker level that gives a present ation pointer to show the exhibition of each sub-measurement. For instance, we could assess the effect of characteristic assets, from asset utilization to contamination and discharge.

Level 4, the last level, is a measurement level that gives a definition to gauge manage ability execution.

For instance, asset utilization execution is shown by the amount of water utilization, land use and soil quality.

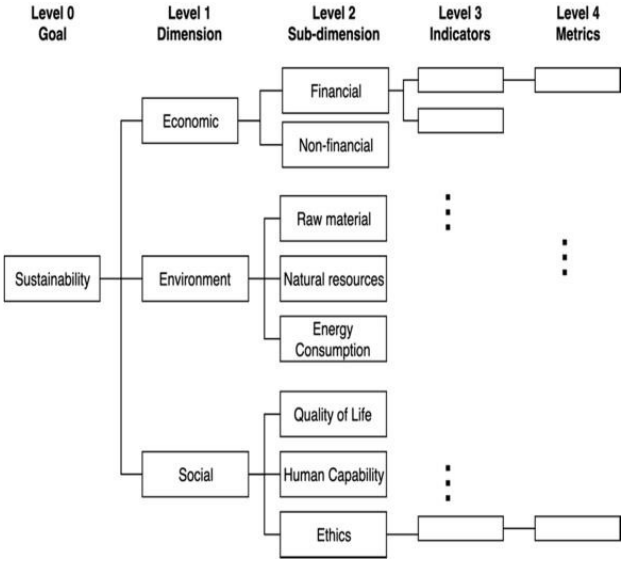

Figure 3.Estimation Model Proposed

To actualize the maintain able farming presentation estimation model,[20] recommended that choice maker(s) should utilize level 0 to level 2 as a structure to choose explicit pointers (level 3) and measurements (level 4) that

are proper for their application. Accordingly, this work will develop the exhibition pointers and measurements that identify with brilliant innovation execution infarming.

This work chosen seven sub-measurement (level 2) and the subtleties are as per the following:

- Financial measures identify with expanding income, benefit, piece of the overall industry, decreasing the expense of activity and unit cost.
- Non-monetary measures identify with improving item quality, crop every year and diminishing harvest time.
- Raw material measures identify with moderating and improving the crude material by proficient use through the lessen, reuse and reuse ideas; diminishing risky material use; and decreasing deformities and wasteage.
- Natural asset (water, soils, and land use) measures identify with moderating and improving the characteristic as set base by effectively utilizing and diminishing natural emanation.
- Quality of life measures identify with evaluating and diminishing the potential wellbeing effects of new innovations just as expanding the prosperity of partners.
- Human capacity models identify with urging schooling to improve human abilities and information execution.
- Ethics measures identify with regarding neighborhood and global laws on business and common freedoms and supporting moral working practice issues.

Discussion

The shut climate of a plant industrial facility confines crop creation from an outside climate. Thusly, the plant development factors, for example, water, light, carbon dioxide fixation and supplements are controllable. A plant industrial facility control framework can quantify the ecological conditions, for example, temperature, sweetness and light power and react by changing the plant development factors through regulators. Estimation and responsiveness capacities rely upon the sensors' information assortment and capacity and on the preparing capacity of distributed computing withAI and Big Data investigation. In addition, the compelling administration framework and information representation urge ranchers to use sound judgment to work their creation.

Monetary Dimension

Increasing item quality: accuracy estimation and inappropriate plant development factor change lead to better quality. It tend stobe seen that the items from the plant industrial facility are higher in weight per unit and have as uperior quality evaluation and a lower level of deformities.

Increasing profitability: the creation efficiency of the plant industrial facility is higher than the traditional development because of the expense decreases from asset use (water and treatment), the increment of item weight per unit, and the measure of work decrease.

Increasing crop every year: the plant production line has a man-made consciousness framework totally stopped the external climate. It replaces daylight with controllable lighting sources and controls other plant development factors, for example, stickiness, carbon dioxide fixation, temperature and supplements by utilizing a man-made brainpower framework. Thusly, a plant can accomplish an all-year creation climate. The plant production line produces around twice as much yield every year contrasted with regular farming and decreases gather time by around 50% contrasted with conventional development.

Natural Dimension

Increasing asset use effectiveness: the plant improves crop water system water efficiency because of a water control framework that lessens depleted water in the developing zone and reuses water fume into fluid water. The vertical cultivating of the plant manufacturing plant expands land use proficiency. It gives a 99% decrease in landuse.

Social Dimension

Increasing sanitation: the plant production line offers need to keep the developing territory liberated from irritations and pesticides. These cleanliness conditions make a prepared to-eat items in the wake of collecting. Additionally, the data innovation in the plant processing plant permits clients and partners in the production network to follow operational information frommakers.

Increasing representatives' personal satisfaction: the controllable workspace in the plant is consider ably more alluring than field development, which includes the vulnerability of warmth and climate. Further, to work with programmed and high innovation frameworks, the plant production line requires exceptionally gifted laborers. It urges workers to improve their abilities and information.

Obviously, the plant with fake framework improves the support ability executionin all financial, natural and social points of view. The secluded climate of the plant manufacturing plant gives various favorable circumstances to improving profitability, improving quality, expanding asset use effectiveness, and expanding food handling. Be that as it may, plant production lines will in general require a more prominent energy input. Because of the way that free energy from daylight has been dismissed from this developing framework, the plant processing plant needs new energy to give a light source to the framework. It This prompts a lot greater expenses of lighting in the plant manufacturing plant. The power cost addresses almost one-fourth of the creation costs[21] This issue can be settled and further explored in future exploration.

Conclusion

Innovative turn of events and digitalization shape attainable limits to build asset use effectiveness. Savvy agri business diminishes the negative natural effects of cultivating, expands flexibility and soil well being and diminishes costs for ranchers. The number and kinds of difficulties related with savvy cultivating grow across different farming creation frameworks, and infrastructural constraints apply with regardsto IoT execution. The plant production line is one of the answers for take care of the issues with respect to food sources, assets, and the climate. Procedures have been created by which the yield and nature of food sources are improved, with less utilization of assets and less ecological debasement than the current plant creation framework. The likely advantages of the plant production line are upgrade dmonetary and natural support ability.

References

1. Braun AT, Colangelo E, Steckel T. Farming in the era of industrie 4.0. *Procedia CIRP* 2018; 72: 979-984.
2. Saunila M, Nasiri M, Ukko J. Smart technologies and corporate sustainability: The mediation effect of corporate sustainability strategy. *Comput Ind* 2019; 108: 178-185.
3. Voutos Y, Mylonas P, Katheniotis J et al. Asurvey on intelligent agricultural information handling methodologies. Sustainability. 2019; 11: 3278.
4. Kozai T. Sustainable plant factory: Closed plant production systems with artificial light for high resource use efficiencies and quality produce. *Acta Hortic* 2013: 27-40.
5. Pivoto D, Waquil PD, Talamini E et al. Scientific development of smart farming technologies and their application in Brazil. *Inf Process Agric* 2018; 5: 21-32.
6. Ray PP. Internet of things for smart agriculture: Technologies, practices and future direction. *J Ambient Intell Smart Environ* 2017; 9: 395-420.
7. FAO. The Future of Food and Agriculture-Trends and Challenges; FAO: Rome, Italy, 2017. Available online: http://www.fao.org/3/a-i6583e.pdf
8. WCED, S.W.S. World commission on environment and development. *Our Common Future* 1987; 17: 1-91.
9. Senanayake R. Sustainable agriculture: Definitions and parameters for measurement. *J Sustain Agric* 1991; 1: 7-28.
10. Elkington J. Cannibals with Forks: The Triple Bottom Line of 21st Century Business; Capstone: Oxford, UK. 1999.
11. Santiteerakul S, Sekhari A, Bouras A. Sustainability indicators for evaluating sustainable supply chain. In Proceedings of the International Conference on Green and Sustainable Innovation (ICGSI), Chiang Mai, Thailand. 2012.
12. Veleva V, Ellenbecker M. Indicators of sustainable production: Framework and methodology. *J Clean Prod FAO. Sustainability Assessment of Food and Agriculture Systems (SAFA)*; Natural Resources Management and Environment Department Food and Agriculture Organization of the United Nations: New York, NY, USA, 1998. 2001; 9: 519-549.
13. Jawtrusch J, Schader C, Stolze M et al. Sustainability monitoring and assessment routine: Results from pilot applications of the FAO SAFA guidelines. In Proceedings of the International Symposium on Mediterranean Organic Agriculture and Quality Signs Related to the Origin, Agadir, Morocco, 2013.
14. Santiteerakul S, Sekhari A, Bouras A. Sustainability performance measurement framework for supply chain management. *Int J Prod Dev* 2015.
15. Sopadang A, Wichaisri S, Banomyong R. Sustainable supply chain performance measurement a case study of the sugar industry. In Proceedings of the International Conference on Industrial Engineering and Operations Management, Rabat, Morocco, 2017.
16. Grenz J, Thalmann C, Stampfli A et al. RISE-A method for assessing the sustainability of agricultural production at farm level. *Rural Dev News* 2009.
17. Kamali FP, Borges JAR, Meuwissen MP et al. Sustainability assessment of agricultural systems: The validity of expert opinion and robustness of a multi-criteria analysis. *Agric Syst* 2017; 157: 118-128.
18. Weerapan T. Performance Measurement of Organic Vegetables in Sustainable Supply Chain Management. Master's Thesis, Chiang Mai University, Chiang Mai, Thailand. 2018.
19. Weerapan T, Santiteerakul S. Indicators of performance measurement for agriculture sustainable supply chain. In Proceedings of the International Conference of Simulation and Modeling (SIMMOD), Pattaya, Thailand. 2017; 130-137.
20. Kozai T, Niu G, Takagaki M. Plant Factory: An Indoor Vertical Farming System for Efficient Quality Food Production; Elsevier: San Diego, CA, USA. 2015.