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Artificial Intelligence in Agriculture: A Literature Survey

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ABSTRACT

Agriculture plays an important role within the economic sector. Automation in agriculture is the main concern and also a growing topic worldwide. In crop production systems there are field operations that are quite labor-intensive, either owing to their complexity, or because they're related to the fragile interaction between plants and edible products, or due to the repeatability that they require throughout the production cycle of harvest. In the agricultural field, various works are carried out, such as sowing, weeding, cutting, chemical spraying, etc. This work proposes a kind of autonomous agricultural system replacement for various applications in the fields of agriculture which is to examine the various uses of automation in agriculture such as irrigation, weeding, fumigation using sensors and various means built into robots and drones. Automation greatly adapts the farming system to prevent people from using and performing harmful tasks or working in a harsh environment.

Keywords-:Agriculture, AI, IOT, autonomous, farming machinery,Smart farming

INTRODUCTION

Agriculture and farming are considered some of the most exhaustive works which require a lot of effort to perform seeding, planting, weeding, spraying, and harvesting. Robotics technology has helped us to enhance the standard of our lives in several aspects. Nevertheless, theuse of robots in agriculture, especially in agricultural activities, poses a challenge for scientists and engineers. Robots can help us to plantand watermore precisely and also to control weeds and pests more precisely. These all mean higher quality products, cheaper food, and less labor. The challenges for robots in agriculture are several. On the other hand, industrial processes are often designed by modules to use specific robots to specific works, whereas the complex tasks of agriculture sometimes can't be split into simple actions. For the reasons mentioned above, agricultural applications require more versatile and robust robots. The automated system will require fewer farmers and less time compared to the old working methods. For an economical management there is a need for autonomous and time-saving technology in agriculture. The researchers are currently aiming towards different types of farming parameters to vogue autonomous multipurpose agricultural robots due to ancient farm machinery and topological dependence.

To date, multipurpose agricultural robots are researched and developed mainly for harvesting, fertilizer spraying, picking fruits, sowing, and monitoring crops. Robots like these are brilliant replacements for manpower to a far better extent as they deploy unmanned sensors and machinery systems. The agricultural benefits of developing these intelligent, autonomous robots are improvedrepeatability, efficiency, reliability and minimization of soil compaction and chemical use.The robots have the potential of multitasking, sensory measures, idle operation as well working in various working conditions. The study on multipurpose agricultural robot systems had been done using model structure design along with various precision farming machinery. With fully automated farms in the future, robots can perform all the tasks like plowing, seed sowing, pesticide spraying, monitoring of pests and diseases, harvesting, etc. This allows the farmers to just supervise the robots without the need for manual operation. The implementation of AI-based approaches can detect diseases or climate change earlier and react in an orderly manner. With the help of AI, agricultural companies process agricultural information in order to reduce negative consequences.

LITERATURE SURVEY

Juan Jesús Roldán, Jaime del Cerro, and others talked about the main areas of application of agriculture such as precision agriculture and greenhouse cultivation and gathered information on planting and harvesting, environmental monitoring in the field as well as the inspection and treatment of plants. They also talk about the robots proposed to accomplish these tasks for example manipulators, ground vehicles, and airborne robots. The authors defined studies initiatives associated with precision agriculture and greenhouse cultivation. [1]

Agricultural robots have been the subject of extensive research and development for decades and are being studied by many groups around the world. Robert Bogue aims to provide an overview of some important and recent research and developments in agricultural robotics. He also mentions therobots developed so far, for example: ladybug robot, RIPPA robot, harvesting robot. [2]

The agricultural enterprise faces numerous demanding situations along with loss of green irrigation systems, weeds, crop tracking issues because of crop altitude and severe climate conditions. But performance is often increased with the help of technology and thus these problems are often solved. It can be augmented with various AI-based techniques such as remote sensing for soil, image processing for weed detection, chatbots for farmers, automation of irrigation using technologies. Various AI, agricultural drones to improve efficiency. [3]

The authors presented the need, benefits, applications and success stories of using agricultural robots in agriculture. They review the successes of robotic farming in different fields of agriculture. N. Vamshidhar Reddy, S. Pranavadithya and others presented the use and results of using robots in agriculture, they tried to increase their knowledge about the use of agricultural robots on behalf of farmers, especially in developing countries like India, Paraguay, Albania, Guinea, etc. [4]

An exciting innovation within the Smart Farms concept was a robot for watering pots in agricultural greenhouses that uses sensors for humidity, position, and computer vision to estimatethe amount of water each plant needs individuallyand thenruns the water slide required foreach plant. This technique makes it possible to save lots of water and substantially improve irrigation efficiency. [5]. Prajna K.B. provided a brief overview of the different types of robotic technologies used in agriculture and the ideaof a general-purpose robot was presented. [6]

Agriculture performs a vital function for the country. Smart agriculture is consequently necessary. The Internet of Things will assist to enhance clever agriculture. The IOT works in various agricultural fields to improve time efficiency, water management, crop monitoring, soil management, pesticide and pesticide control, etc. [7]

Redmond RaminShamshiri and others conducted an insightful review of agricultural robotics. It challenges and special attention is given to multirobot and swarm methods [8]. Blender Timo, Thiemo Buchner, et al. presented the Mobile Agricultural Robot Swarms (MARS) as a proposal for autonomous farming operations using a set of coordinated robots and described an application in seeding. [9]

V. Dharmaraj and C. Vijayanandgives a vision of how different agricultural sectors are often exploited using AI. It also studies AI Powered ideas for the future and therefore the challenges that are anticipated in the future. [10].

Sicat et al. [11] used information from farmers to model a fuzzy-based system to recommend crops based on the land suitability map generated by the fuzzy system. Other fuzzy-based systems include Si et al. [12], Tremblay et al. [13].

Artificial neurological network systems to evaluate the soil moisture of Paddy Arif et al. [14]. Other popular systems using artificial neuron networks for soil and irrigation are patriol et al. [15], Hinnell et al. [16] Junior et al. [17].

Modern AI methods are applied to reduce herbicide use through proper and precise weed management. Burks and colleagues [18] used reverse propagation machine vision to train a neural network to identify weeds of five distinct species. Following a different approach from Shi et al., [19] was developed using image analysis and neural networks.

B.Ragavi et al. proposed "AGROBOT" based on IoT and AI for the seed-sowing mechanism. It Monitors weather conditions, fertilizer and pesticide needs, water needs. Using cloud services, information is sent to farmers for live monitoring of the field. Reduces labor costs and improves harvest to produce. [20]

METHODOLOGY

The use of technology in agriculture started a long time ago, but today the interdependence of the internet and the automation of agriculture has shown its niche in the technological world as it is an emerging field in this digital and intelligent age, AI and IoT justify their role in enhancing agricultural practices. The analysis of the articles for this study comes from various journals and conference proceedings available in most of the prestigious research databases. Most of the knowledge and methods discussed have put the observed predictive analytics and application into practice.

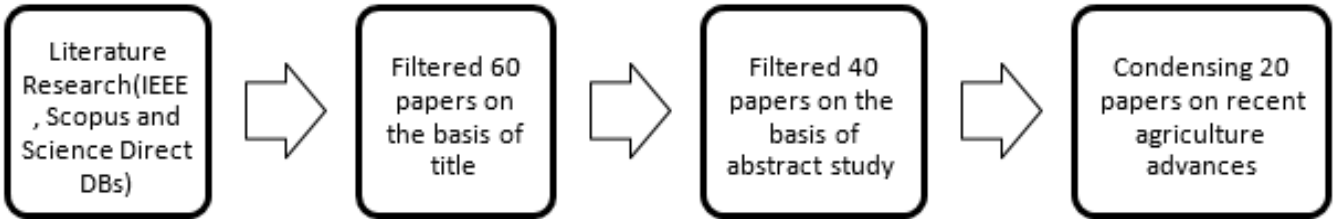

Figure 1: Literature Review Process

The review of the literature review began with a search of major school databases (IEEE, Scopus and Science Direct) on agriculture and its practices. The keywords and phrases contained were "Smart Agriculture", "Irrigation Systems", "AI and IoT in Agriculture", "Use of Technology in Agriculture". There were two main criteria for the initial filtering: the year of publication and the quality of the journal (considering the impact factor and the number of citations). The studies were then refined based on the title and abstract. At least 100 articles were registered to gain insight. 60 articles were peer-reviewed by title and then 40 by eliminating the abstract base. Finally, based on the current progress in technological agricultural activities, a review of 20 research papers were registered.

CONCLUSION

In agriculture, by using theAI farming system we can easily reduce the manpower, farming tools and equipment, as well as investments. The automated system will require less farmers and less time compared to the old working methods. AI can be acceptable and effective in agriculture because it optimizes the use and power of resources. It solves the scarcity of resources and manpower in excess. The introduction of AI is somehowuseful in agriculture.In this paper, several articles were reviewed and it was observed that working productively with IoT and AI is possible in agricultural activities. 20 articles were examined in the literature review. All recent advances in the use of these technologies are discussed and reviewed, and it is predicted that agriculture based on AI and IOT can reduce farmers' stress on crop production and their reliability in the face of unexpected trends in the weather forecast, and also lowering labor costs.There is a desire for autonomous and time saving technology in agriculture to possess efficient farm management.

REFERENCES

[1] J.J.Roldán,J.delCerro,D.Garzón-Ramos,P.Garcia-Aunon,M.Garzón,J. de León and A. Barrientos. Robots in Agriculture: State of Art and Practical Experiences. Service Robots. In Tech, 2018
[2] Bogue R. "Robots poised to revolutionise agriculture." Ind. Rob., 43(5): 450–456,2016
[3] Tanha Talaviya, Dhara Shah, Nivedita Patel, HiteshriYagnik,MananShah,"Implementation of artificial intelligence in agriculture for optimisation of irrigation and application of pesticides and herbicides",Artificial Intelligence in Agriculture,Volume 4, ISSN 2589-7217 Pages 58-73, 2020
[4] N.V.Reddy, A.V.V.Reddy, S. Pranavadithya and J.J. Kumar, "A critical review on agricultural robots," *International Journal of Mechanical Engineering and Technology*, Vol.7, No. 4, pp.183-188, 2016.
[5] Batista, A. V. D. A., Albiero, D., Viana, T. V. D. A., Monteiro, L. D. A., Chioderoli, C. A., Sousa,I.R.S.D.,&Azevedo, B.M.. Multifunctional Robot at low cost for small farms. *Ciência Rural*, Santa Maria, vol.47, no.7, 2017.
[6] Prajna, K. B. "Review of Robots in Agriculture", *International Journal of Science Technology and Engineering*, vol. 4, no. 6, pp. 50-54, 2018.
[7] Vinayak N. Malavade, Pooja K. Akulwar. "Role of IoT in Agriculture", IOSR Journal of Computer Engineering (IOSR-JCE) e-ISSN: 2278-0661,p-ISSN: 2278-8727 PP 56-57, 2016.
[8] R Shamshiri, Redmond, et al. "Research and development in agricultural robotics: A perspective of digital farming", *Int J Agric & Biol Eng*, vol. 11, no. 4, pp. 1–14, 2018.
[9] Timo Blender, Thiemo Buchner, Benjamin Fernandez, Benno Pichlmaier, and Christian Schlegel, 'Managing a mobile agricultural robot swarm for a seeding task', in IECON 2016-42nd Annual Conference of the IEEE Industrial Electronics Society, pp. 6879–6886, 2016
[10] V. Dharmaraj and C. Vijayanand, "Artificial Intelligence (AI) in Agriculture," International Journal of Current Microbiology and Applied Sciences, vol. 7, no. 12, pp. 2122-2128, 2018.
[11] R. S. Sicat, Emmanuel John M. Carranza, and Uday Bhaskar Nidumolu, "Fuzzy modeling of farmers' knowledge for land suitability classification," Agricultural systems, vol. 83 no.1, pp. 49-75, 2005.

[12] Y. Si, G. Liu, J. Lin, Q. Lv and F. Juan, ―Design of Control System of Laser Leveling Machine Based on Fuzzy Control Theory, In Proc. International Conference on Computer and Computing Technologies in Agriculture (pp. 1121-1127). Springer, Boston, MA.
[13] N. Tremblay, et al., "Development and validation of fuzzy logic inference to determine optimum rates of N for corn on the basis of field and crop features," Precision Agriculture, vol. 11 no. 6, pp. 621-635, 2010.
[14] C. Arif, M. Mizoguchi, and B. I. Setiawan, "Estimation of soil moisture in paddy field using Artificial Neural Networks", arXiv preprint arXiv: 1303.1868, 2013.
[15] S. S. Patil, et al., "Web based expert system for diagnosis of micro nutrients deficiencies in crops," in Proceedings of the World Congress on Engineering and Computer Science. Vol. 1. 2009
[16] A. C. Hinnell, et al., "Neuro-Drip: estimation of subsurface wetting patterns for drip irrigation using neural networks," Irrigation science, vol. 28 no.6, pp. 535-544, 2010.
[17] J. da Silva, et al., "Comparison of mapping soybean areas in Brazil through perceptron neural networks and vegetation indices," African Journal of Agricultural Research, vol.11 no.43, pp. 4413-4424, 2016.
[18] T. F. Burks, et al., "Backpropagation neural network design and evaluation for classifying weed species using color image texture," Transactions of the ASAE, vol. 43 no. 4, pp. 1029-1037, 2000.
[19] Y. Shi, H. Yuan, A. Liang, and C. Zhang, ―Analysis and Testing of Weed Real-time Identification Based on Neural Network, In Proc. International Conference on Computer and Computing Technologies in Agriculture (pp. 1095-1101). Springer, Boston, MA, 2007
[20] Ragavi B, Pavithra L, Sandhiyadevi P, Mohanapriya GK, Harikirubha S, "Smart Agriculture with AI Sensor by Using Agrobot," in IEEE, 2020.