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Message from the Editor-in-Chief

Dear Colleagues,

The Online Journal of Distance Education and e-Learning (TOJDEL) welcomes you. TOJDEL would like to thank you for your online journal interest. The online journal system has been diffused very fast since January, 2013. It has continued to diffuse new trends in distance education and e-learning all over the world. We hope that the journal will also successfully accomplish our global distance education and e-learning goal. Any views expressed in the journal are the views of the authors and are not the views of the Editor and TOJDEL. We hope that volume 11, issue 1 Chapter 1 will also successfully accomplish our global publication goal. TOJDEL is confident that readers will learn and get different aspects of distance education. Any views expressed in this publication are the views of the authors and are not the views of the Editor and TOJDEL.

The editors of this issue are Prof. Dr. Satish Pawar, Assoc. Prof. Dr. Nilesh Anute, Assoc. Prof. Dr. Amirul Mukminin, Assoc. Prof. Dr. Figen Yaman Lesinger, Assoc. Prof. Dr. Dilan Çiftçi, Assoc. Prof. Dr. İrfan Şimşek, Assist. Prof. Dr. Mustafa Oztunc, Assist. Prof. Dr. Hüseyin Eski, Çiğdem Karagülmez Sağlam & Gamze Peler Şahoğlu. TOJDEL thanks for their valuable effort to review the papers.

TOJDEL will organize INTE-2023 International New Horizons in Education Conference (www.int-e.net) between July 28-29, 2023 in Roma, Italy. This conference is now a well-known education event. It promotes the development and dissemination of theoretical knowledge, conceptual research, and professional knowledge through conference activities. Its focus is to create and disseminate knowledge about education science.

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January 01, 2023
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IOT DEVELOPMENT IN THE AGRICULTURE SECTOR

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ABSTRACT
Agriculture and related industries contributed 15.4 percent of the country's GDP. The technological revolution is fetching a massive change in every sector. The agricultural sector is not exceptional. The farming sector is ultimately becoming more important in the modern era with the initiation of the technology of the Internet of Things. The present study is to explore IoT Technology in agriculture and its environment. What enabling technologies and components are used in the agriculture sector? How does it work and access, store, and share data through sensors? Furthermore, it provides insight into IoT technology and developments in IoT and its understanding of the phenomenon. This study also aims to provide the ordinary reader, who has no idea about IoT, its systems, its environment, and smart farming, an easy-to-grasp overview.
Keywords: Agriculture, Technology, IoT, Development.

Introduction

In terms of agricultural production, India is second only to the United States. According to estimates, agriculture and related industries like animal husbandry, forestry, and fisheries employed more than half of India's workforce. Agriculture and related industries contributed 15.4 percent of the country's GDP. In the GDP of India, the agricultural contribution is slowly dropping as the nation's broad-based economic expansion continues. With the highest net cropped area India was ranked first in the world. The overall export of agricultural products. During 2016-17, India was the seventh-largest country in agricultural exporter and in net exporter it was sixth. More than 120 nations import Indian agricultural and horticulture products and processed meals. According to Dr. Bright Singh, "Increase in agricultural production and the rise in the per capita income of the rural community, together with the industrialization and urbanization, lead to increased demand in industrial production." It indicates that the agricultural industry promotes economic development by securing an enhancement to the industrial sector.

Due to the change in climate, the farmers' revenue will be reduced by 25 percent which is impacting the nation in many ways. The uncertainty in rainfall, temperature and the increase in the number of dry days are all attributed to climate change. Out of India's net sown area of 141.4 million hectares, more than 50% area (73 million) is still unirrigated which depends on rainfall. In recent economic studies, it has been shown that there is a necessity of the utilization of advanced technology to ensure sustainability of agriculture for all. The common practices in agriculture productivity lead to water shortages, and wastage of fertilizer and it increases the time and cost. According to the Economic Survey, irrigation has to be "dramatically" improved by using modern technology. New technology is needed to increase agricultural output and minimize time and cost in the current situation.

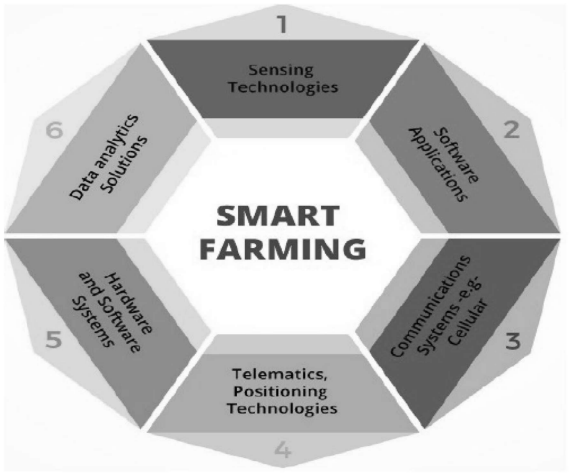

Figure 1: Components of Smart Farming

The technological revolution is fetching a massive change in all sectors. The agricultural sector is not exceptional. The agriculture sector is ultimately becoming more important with the beginning of the new technology of the Internet of Things. It is restructuring how farmers can trudge, harvest, and maintain crops. With the smart IoT concept, the idea of transforming agriculture is booming with new technology. The farmers can track the growth of crops and keep a record for future perspectives. This maintains the quality and guides the necessities for healthy plant growth. Through modern technology, it is possible to more precise farm or agriculture management. To ensure the crop and soil optimum health and productivity smart or precision agriculture (PA) is the way to manage agriculture activities by using advanced technology, especially information devices. The objective of smart farming is to confirm the sustainability with the profitability and protection of the environment and it is a management approach to the farm IoT that helps precision farming and smart agriculture to forecast the incoming weather conditions and evaluate the farm requirements to avoid difficulties during farming activities. The changes in attributes of yield or soil are observed, recorded and distinguished by using remote sensing (RS), global position system (GPS), and geographical information system (GIS) technologies. Further, the actions are taken as a significance of the continued evaluation of the spatial variability within that field. In modern days it is called a site-specific management system by adopting advanced technology. It provides a possible step change in productivity and efficiency. In the context of Indian precision, the farming scenario is based on traditional farming knowledge due to that the cost of input is high and with the decreasing commodity prices, Indian farmers are looking for new ways to increase efficiency and reduce cost.

IoT is transforming the farming sector in multiple ways. Every area that covers a farm is increasing its potential with the usage of IoT technologies. Through the IoT, field management and monitoring, crop supervision, and livestock management become smarter and better. The Internet of Things provides a data-driven approach for the future management of agricultural activities with reduced wastage and maximized efficiency of equipment and overall growth. Implementing smart IoT technologies in farming helps in providing real-time data which improves decision-making through better analytics and increases quality productivity. Implementation of IoT technologies can increase the potential of fields and take the farming business to greater heights.

The present paper highlighted the development of IoT and Agri activities with the prime objective being the current development condition of the internet of things in the agriculture sector based on the available technology analyses. Also, this study gives an insight into IoT in agriculture to the common person. The present paper is majorly based on secondary data.

Review of Literature

Sinha and Dhanalakshmi (2022) primely discussed the future trends in the agriculture sector with the security issues, major components, new technologies, and challenges. This study helps to find problems in IoT adoption and application necessities to implement appropriate technologies. For the transformation of information, IoT is an evolving paradigm that seeks the connection of multi-type of technologies. In the present article, the author introduces an IoT based framework which automatically manages and tracks agricultural lands with minimal human intervention.

Morais, Mendes, Silva, Nuno, Joaquim, Sousa and Peres (2021) focus their study to gather the framing information on low-power and cost IoT technologies. It indicates that the IoT software and hardware resolutions are both enough to fit the task of data gaining with different availability of sensors. In the present article, the authors focus on precision agriculture practices that depend on hardware solutions.

Pachayappana, Ganeshkumar & Narayanasam (2020) have emphasized technological application and their effect on the agricultural business. They proposed an IoT framework for agriculture which is based on monitoring and controlling the growth of crops. The proposed framework simplifies the decision to visualize the production position at any moment and makes them take the decision for any change in practices. IoT technologies are modified with communication devices that allow connecting with people and physical things that enable quick decisions.

Khursid, Muzafar & Rana (2020) have reviewed the system consisting of a sensor network for humidity, temperature, soil moisture, colour, and water level sensors. The controller unit is used to control the irrigation motor thereby controlling the water flow to the field. In addition to that, a water level sensor is placed in this field. Modern programming Raspberry pi is used in the controller mode. Internet of the things (IOT) is an ecosystem of connected physical objects that are accessible through the internet.

Agarwal (2020) discussed the challenges and opportunities in the adoption of IoT technologies in agriculture. He focuses on the spectral properties and vegetation is strongly determined by biophysical and biochemical

attributes such as leaf area Index. Remote sensing is the measurement of reflected radiations rather than transmitted or absorbed radiations. GIS, GPS, and computing science are more important in smart agriculture to value integration.

Raikar, Desai, Vijayalakshmi & Narayankar (2020) has emphasized that the emergence of the IoT has a transformative direct effect on our society and forces us to rethink how to educate the next generation. As a result, IoT is the network of all kinds of things embedded with sensors, electronics, software, and people connected to the Internet.

Gomez, Aviles, Moran, Grijalva & Tanya Recall (2019) have highlighted IoT technologies and their applications in agriculture in this article. Also highlighted on various technologies available in the market for agriculture activities. It provides the benefits of various Agri-IoT technologies and how different agricultural processes can be supported by these technologies.

Muangprathuba, Boonnama, Kajornkasirata, Lekbangponga, Wanichsombata & Nillaorb (2019) has emphasized data mining and analysis for smart farms and evaluated the agriculture data. Secondly, they focus on web-based applications that were designed and implemented to manipulate the details of crop data and field information. For the future management of farms, these components use data mining and analyse the data for predicting suitable temperature, humidity, and soil moisture for crops growth. Finally, they focus on controlling devices for crop growth through a mobile application in a smartphone which permits the user for automatic or manual control. The automatic control uses data from soil moisture sensors. However, the user can opt for manual control of growth of crops in the functional control mode.

Jaiganesh & Gunaseelan (2017) studied the agro cloud technologies and emphasized upgrading agricultural generation and accessibility of information. Today agriculture is inserted with propel benefits like GPS, sensors that empower to impart information to each other, break down the information and furthermore trade information among them.

Gondchawar and Kawitkar (2016) highlight features of smart GPS-based remote-controlled robots to perform various agri tasks. Secondly, it includes smart irrigation with smart control and intelligent decision-making based on accurate real-time field data. Thirdly, smart warehouse management which includes temperature maintenance, humidity maintenance and theft detection in the warehouse. Controlling of all these operations will be through any remote smart device or computer connected to the Internet.

Technologies used in Agriculture

For smart farming, it is essential to anyone familiar with modern technologies and available tools. The range of advanced tools including software and hardware promotes smart agriculture management. These technologies and their benefits are discussed as follows –

Mapping

Mapping is testing various properties of the yield which is the most essential for smart agriculture management. It is the first step that provides the basis for controlling spatial variability. Before and during crop growing both the information and data are provided and by using GPS the precise location manages to enhance productivity. The technologies of data collection are connected with yield monitoring, soil and crop inspections, and RS. During the crop creation, the data gathering through the sensing devices and RS, GIS, and manual mapping can be completed.

Global Positioning System (GPS) receivers

The global positioning system (GPS) allows receiving singles through the satellite broadcast singles to identify the location and added. The information of continuous position is provided in actuality in a moment and permits plotting the yield position and measurements. The GPS singles provided access to the operator for the sample area by returning the specific locations.

Yield monitoring and mapping

There are various mechanisms for monitoring and plotting the yield in the market. The grain yield monitoring system nonstop measures and records the flow of grain and cleans it. GPS is linked with yield monitoring and the necessary data will be mapped. Soil, environmental and other factors will be considered in yield mapping to make a sound management decision. Crop information provided the necessary and important feedback in defining and use of inputs of fertilizer, seed, irrigation, and pesticides.

Grid Soil Sampling
Soil testing data facilitated the crop advisory and recommended the fertilizer application. To increase the intensity of sampling grid soil sampling is used. Grid soil sampling aims to prepare the network of requirements.

VRT Application
The fertilizer applications test the set of soil samples. For the application of the plot, the variable rate fertilizer (VRT) spreader is attached to a computer attached and according to the application map and GPS receiver instructed to the fertilizer delivery controller to change the quantity of fertilizer product.

Remote Sensing
Remote sensing technology provided the data from distance. To evaluate crop health, stress, moisture, nutrients, compaction, diseases, and other plant concern issues remotely sensors provide tools. Electronic cameras record infrared images and match them with healthy crops or plant concerns. To determine the location and crop stress remote sensing devices help analyze the images and determine causes. Such information helps to implement a spot treatment and optimize the use of pesticides and fertilizers.

Geographic Information Systems (GIS)
GIS is a combination of various physical devices (hardware) and software which provides site data to produce maps and use feature attributes. GIS agriculture is an important function to store layers of information. With the accumulation of a visual perspective for interpretation geological data can be exhibited in the GIS. To evaluate the present and alternative solutions GIS can be used by merging data layers to provide the analysis report to management.

Quantifying Farm Variability
Quantifying on-farm variability is an incremental approach and smart strategy by adopting more than one device at the same time and analysing the results. Soil, organic variation, and water holding capacity along with structure provide a clearer view of the farm. This will provide more insight to the user to give the inputs to the soil. The major concern is to quantify soil variation. The gathering of data and analysis only offers one base layer of information. There are various devices for sampling. These systems determine the variability across a farm. Geography differences within the farm can map but determination on these is insufficient to give detailed information about fields.

Variability of Soil Water
In general, the variability of soil water is a present level or content of water in the soil or a field that differs over time and place. For smart framing, the variability in soil water patterns is important and has reflective implications. Smart management of water needs proper information on the primary distribution of soil water and it saves water, energy, labor, and equipment cost and leads to improved production efficiency.

Time and Space Scales
Time and space parameters are more important and understanding these parameters is necessary for precision agriculture. The space scale is the fundamental thing of smart farm management due to the input and traditional practices that differ with soil type and crop growing. The time scale is a critical component due to various processes and actions that ensure crop benefits. The major challenge for smart agriculture is a better-quality understanding and determining use of time and space scales. Proper management of space and time context and monitoring to document the changes are more important to accomplish precision agriculture.

Conclusion
The purpose of the study is to identify and assess IoT systems in agriculture. Many kinds of literature and studies show that various technologies and applications are utilized for smart agriculture management. IoT makes smart agriculture through various technologies and applications. The Internet of Things has been introduced in many areas including agriculture. The main focus is on the management of farms and reducing costs. The major issues are the security of data, awareness among the farmers, suitability for small farms, and effectiveness of cost. There is a need for more focus on Scalability, Interoperability, Government Support, Security and Privacy, Safety of Patients, and Designing Challenges. Integrated efforts of government, IoT manufacturers, and agricultural associates help to promote IoT development and its usages in agriculture.

References
Ariful I., Kohinur A., NoorJahan N., Das A., Rahman M. & Rahman (2018). “IoT Based Power Efficient Agro Field Monitoring and Irrigation Control System”: An Empirical Implementation in Precision Agriculture. Innovations in Science, Engineering, and Technology

Anusha A. Shettar, Shanmukhappa A. & Angadi (2016), "Efficient data mining algorithms for agriculture data," International Journal of Recent Trends in Engineering & Research (IJRET), vol. 02, no. 9, pp. 142-149.

Ayaz M., Ammaduddin M., Sharif Z., Mansour A. & Aggoune H. (2019), "Internet-of-Things (IoT) based Smart Agriculture": Towards Making the Fields Talk

Balakrishna G. & Rao M. (2019), "Study report on using IoT agriculture farm monitoring," Innovations in Computer Science and Engineering, Lecture Notes in Networks and Systems, vol. 74, pp 483-491.

C, Guimaraes, & Ghosh, K., (2012)."Re-orienting crop improvement for the changing climatic conditions of the 21st century". Agriculture and Food Security Vol 1:7, doi:10.1186/2048-7010-1-7.

Dhall R., Agrawal H. (2018). "An Improved Energy Efficient Duty Cycling Algorithm for IoT-based Precision Agriculture". Elsevier Ltd

Gandh N., Armstrong L., Petkar O. & Tripathy A.(2016), "Rice crop yield prediction in India using support vector machines," International Joint Conference on Computer Science and Software engineering (JCSSE), pp. 1-5.

Gómez-Chabla R., Real-Avilés K., Morán C., Grijalva P. & Recald T. (2019). "IoT Applications in Agriculture: A Systematic Literature Review". Springer Nature Switzerland

Gondchawar N., Kawitkar R. (2016). "IoT-based Smart Agriculture". IJARCCE

Jaiganesh S. & Gunaseelan. K. (2017). "IoT Agriculture to improve Food and Farming Technology". IEEE

Jiangchuan F. , Zhang Y., Wen W. , Shenghao G. , Xianju L. & Xinyu G. (2021). "The future of the Internet of Things in agriculture: Plant high-throughput phenotypic platform", Journal of Cleaner Production

Khurshid B., Muzafar H. & Rana S. (2020). "Review and Implementation IoT in Agriculture at High Altitude Areas", IRJET

McQueen R., Garner S., Craig G., Manning N., Witten I. (1995), "Applying machine learning to agriculture data", Computers and electronics in Agriculture, Volume 12, Issue 4, June 1995, pp. 275-293.

Morais R., Mendes J., Silva R., Silva N., Sousa J. & Peres E. (2021). "A Versatile, Low-Power, and Low-Cost IoT Device for Field Data Gathering in Precision Agriculture Practices".

Pachayappana M., Ganeshkumar & Sugundan N. (2020). "Technological implication and its impact in agricultural sector: An IoT Based Collaboration framework". Elsevier B.V

Rajeswari S., Suthendran K. & Rajakumar K., (2017) "A smart agricultural model by integrating IoT, mobile and cloud-based big data analytics", International Conference on Intelligent Computing and Control (I2C2).

Ravisankar K., Sidhardha K. & Prabadevi B (2017), "Analysis of agriculture data using big data analytics", Journal of Chemical and Pharmaceutical Sciences, vol. 10, no. 3, pp. 1132-1135.

Sagar S., Kumar G., Xavier L., Sivakumar S. & Durai R., (2017) "Smart irrigation system with flood avoidance technique", in Third International Conference on Science Technology Engineering & Management (ICONSTEM).

Saha A., Saha J., Ray R., Sircar S., Dutta S, Chattopadhyay S.& Saha H. (2018). "IoT-Based Drone for Improvement of Crop Quality in Agricultural Field". IEEE

Saraf S. & Gawali D.(2017) "IoT based smart irrigation monitoring and controlling system", in 2nd IEEE International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT).

Yoon, M. Huh, Kang S., Park J. & Lee C.(2018) "Implement smart farms with IoT technology", in 20th International Conference on Advanced Communication Technology (ICACT).

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