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# AGRICULTIRE CROP YEALDING USING ARTIFICIAL INTELLIGENCE

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**Abstract:**

*Artificial intelligence (AI) is being utilised more and more in numerous aspects of society to help decision-making in diverse contexts. Smart farming technologies, which refers to the rising use of AI and smart gadgets, are expected to have positive effects on the agricultural industry. There are high hopes that smart farming can help both individual farmers and industry stakeholders since the agriculture sector is facing a number of concurrent issues, such as declining margins, intricate pan-European rules, and demands to reduce the environmental imprint. However, the majority of earlier research neglects to take into account all relevant factors and concentrates primarily on a limited number of criteria for adopting and optimising certain smart farming technology. Artificial intelligence (AI) is being utilised more and more in numerous aspects of society to help decision-making in diverse contexts. Smart farming technologies, which refers to the rising use of AI and smart gadgets, are expected to have positive effects on the agricultural industry. There are high hopes that smart farming can help both individual farmers and industry stakeholders since the agriculture sector is facing a number of concurrent issues, such as declining margins, intricate pan-European rules, and demands to reduce the environmental imprint. However, the majority of earlier research neglects to take into account all relevant factors and concentrates primarily on a limited number of criteria for adopting and optimising certain smart farming technology.*

**Key Words:-** *Artificial intelligence (AI) , Smart farming, agricultural*

## I. INTRODUCTION:

Agriculture-related enterprises deal with several issues at once. Diminished margins, challenging pan-European legislation, and internal and external pressure to reduce their environmental impact are a few examples of pressures that must be satisfied. In response, a variety of strategies are suggested to satisfy the demands of farmers. The 21st century provides a broad variety of technical options that might significantly impact farming even though farming has been evolving technologically for ages. The artificial intelligence is one of them (AI). Using AI in farming is often referred to as "smart farming." This phrase has a broad definition and high standards. Increased yields might be achieved via smart farming, which could also lessen farmers' workloads, aid in the adaption to climate change, and secure agricultural for millennia to come. Keeping this in mind, smart farming is anticipated to have an impact on a variety of sectors within the agricultural industry. To name a few, trained AI models are used to anticipate the best times to sow and harvest crops, stop disease and nutrient deficiency outbreaks, and ensure food safety. How smart farming may be applied in Swedish agricultural firms will be examined in this master's thesis.

This thesis, in contrast to the majority of past studies, looks at both technical and nontechnical elements of smart farming in Sweden. Technical details like ideal remote sensing image quality and crucial cybersecurity elements of sensor systems have been examined in a number of past research. These factors are taken into account in this thesis, but other crucial, realistic factors like data ownership and data exchange are also examined. The questioned respondents also talk about non-technical elements of smart farming, such trust and profitability. This multidisciplinary approach offers fresh perspectives on the potential use of AI in Swedish agriculture. A comparison of three distinct agricultural industries—arable farming, milk production, and beef production—is also possible because to the broad scope. This thesis may thus serve as a knowledge base for all parties involved who are interested in gaining a comprehensive grasp of the technical evolution of Swedish agriculture.

Traditional work in agriculture is one of the nation's most important economic and environmental sectors. As the world's population increases, so does the value and need of agriculture. A sustainable balance can only be attained by increasing agricultural output. The long-term productivity of a crop is mostly influenced by environmental factors as climate, soil, and water [1].

For a sizable section of India's population, agriculture is one of the main sources of income, and it is essential to increasing food production. A novel strategy called "smart farming" makes use of developing technologies like the Internet of Things (IoT), with the primary objective of improving productivity while maintaining a low cost of development for the agricultural sector. Increase the effectiveness of agricultural output by using IoT, machine learning, and other contemporary technology [2]. The major objective of this project is to develop a system that can monitor crop productivity and aid it while utilising the least amount of water feasible.

**ADVANCED AGRICULTURE**

Precision agriculture is the use of computer software and network-enabled technology to increase agricultural production's sustainability and efficiency while using less resources and labourers. Precision measurement, management, and assessment of variability in crop output in the space-time continuum are essential to the success of precision agriculture. Because the space-time continuum of crop production has not been adequately addressed, precision agriculture's potential for economic, environmental, and social benefits remains mostly unrealized.

The first wave of the precision agricultural revolution began with the use of satellite pictures and aerial photography. Other significant uses included crop health indicators, variable rate fertiliser application, and weather forecasting. Given that access to satellite data just became possible at the start of the twenty-first century, precision agriculture's achievement is rather amazing. Precision agriculture will be impacted by machine learning and artificial intelligence in a second wave that will result in even more accurate data, forecasting, and topographical mapping.

## II. LITREATURE SURVEY

Hari Ram et al. [2] aims to overcome these issues. This regulator provides an intelligent platform architecture and system structure for the facility agricultural ecosystem based on the Internet of Things. This will accelerate the transition from conventional to modern farming.

The work of Nakutis [6] offers a framework for a remote agricultural system to carry out an automation process that integrates sensors and actuators attached to an IoT gateway running an OPC UA (Open Platform Communications Unified Architecture) server. Since they don't need any knowledge of the process being controlled, sensors and actuators are quite general. The gateway executes control algorithms that generate control stimuli and analyse obtained data. By installing or setting a process controller, this method has the advantage of making it simple to change control rules without needing to update the firmware of nearby sensors or actuators. For the real-time management or monitoring of agricultural operations, the performance of the IoT gateway and the data collection channel's throughput (long-distance radio) are constrained. Therefore, the potential channel "sensors-OPC UA server" throughput is being experimentally investigated. The several agricultural applications that may benefit from the suggested design are discussed.

The Internet of Things (IoT) is changing many aspects of daily life. One paradigm that may use IoT advantages to increase production efficiency and consistency across agricultural areas, enhance crop quality, and reduce unfavourable environmental effects is precision agriculture. An IoT infrastructure tailored specifically for precise agricultural applications was created by Khattab et al. 7]. The three-layer architecture in this study collects important data and sends it to a cloud-based backend for processing and evaluation. The front-end nodes may get feedback actions depending on the data analysis. built a model of the recommended design to show off its performance advantages. In order to allow remote control and monitoring, Deepa et al. [8] created an irrigation system that made use of the ThingSpeak cloud platform, sensors, and IoT devices. The farmer's work is reduced and irrigation is optimised thanks to remote monitoring and control.

In this work, Ryu et al. [9] showed how a connected farm built on IoT technology may provide end users with smart agricultural systems. The advantages of linked farms are emphasised using service scenarios in comparison to prior smart farms, and a thorough design and implementation for connected farms are discussed. The writers

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were certain that the Internet of Things (IoT) is a ground-breaking technology that can benefit many industries, including agriculture. The fact that agriculture provides humans with essential resources like food, fibre, and energy makes it one of the most important industries in human history, according to the authors. Adoption of new technology, particularly the Internet of Things, might help improve the agriculture industry.

In this work, Saraf and Gawali [10] created a system based on IoT and made use of real-time input data. Mobile applications that allow remote administration and monitoring of the field and enable wireless monitoring of field irrigation systems reduce the need for human involvement in irrigation. The cloud platform hosts the data created by the suggested system. In order to predict a plant's water usage, the research evaluates an IoT-enabled cloud system for monitoring and controlling a network of sensors and actuators.

To track the productive growth of agricultural output, Kundu et al. [11] created an IoT-enabled system for the collection of continuous and real-time crop data. A farmer would not be able to do this in the actual world. The suggested system creates data that are first saved, after which they are assessed, precise steps are taken to help the farmer deal with each issue he encounters in the field, ultimately leading to the farmer's success in ensuring the prolific growth of the crops. The installation of drones to assist with tasks like spraying pesticide and insecticides, as well as effectively controlling the specified operating hours of irrigation tanks and motors in accordance with crop demands, are all made possible by the Internet of Things. Now that the data has been properly analysed by the prediction module, they are delivered to the user interface for upcoming usage.

## III. PROPOSED METHODODLOGY:

Our strategy includes a four-tier architecture, with the first layer matching information obtained from different sensors. The first layer, also known as the physical layer, uses sensors to collect data and actuators in the field to put the data into action. The second layer is called the network layer. The second layer's interactions between the front-end layer and the back-end layer are managed by a microcontroller. Between the end clouds and the network layer, the gateway layer serves as an intermédiaire layer.

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The first layer's data is sent to the back-end layer, which would be a cloud that handles data storage, visual analytics, data processing applications, data centre allocation for research, and a front-end interface for a farmer to see the state of the field. Data processing is often done by comparing sensed values to threshold values. Based on the processed data, information about the farm is shown on the mobile application so that farmers can see the condition of the field. The link between the back end and the gateway may be provided by a WIFI module, and the gateway is built using microcontrollers. Applications with IoT capabilities are also used for a number of operations, including real-time water control, water leak detection, and others.

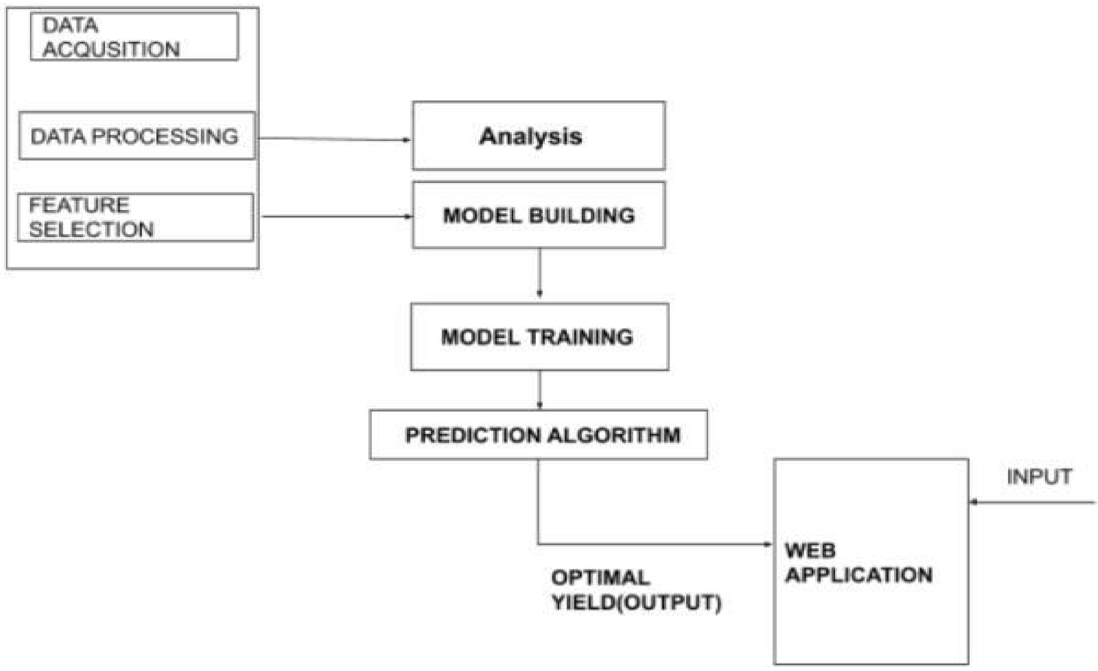


Fig-1 The blueprint of proposed system

Data mining is a knowledge finding method that goes by the general name of KDD. Different algorithms are used to create knowledge from the supplied data. It is used for clustering, classification, association rule learning, regression, and number two. The clustering procedure classifies the data into well-known, pre-defined categories that are comparable to one another. It looks for clusters that can effectively control the data. The data is then sorted into pre-established categories via the classification process. Thirdly, association rule learning examines how the data aspects relate to one another. Regression also identifies the function that stores data with the proper data

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description. Due to its capacity to learn and adapt, agent computing provides a solution to a number of challenging problems in this situation. To get the desired results, the agent group must be integrated into a complex system known as a multi-agent system. The agent has the following qualities: decentralisation, autonomy, and a perspective of the constraint system. Depending on the overall system architecture, the agents may operate partly or independently from a programme. For instance, the agent uses more resources by pretending that certain resources are accessible. As a result, the agent decides whether to execute things rather than wait because the resources are not accessible. When human interventions are entirely eliminated, the autonomous agent analyses the surroundings and acts in accordance with those features.

When using MAS, the autonomous agent executes a predetermined strategy in a dispersed environment. In order to save system resources and communication overhead, the system does not handle every agent. The agent detects the environment in a decentralised property depending on the scope with certain limitations. The agents are integrated with the local system to enable the perspective of the constraint system. As a result, security and privacy are maintained. Analysis and execution are both included in agent-based computing. The approaches for agents are created for desired qualities.

## IV. RESULTS EVALUATION:

Farmers may employ data analytics, which enables them to use real-time data and create forecasts for the crop harvesting period and the potential yield. It aids in the study of meteorological conditions as well. Farmers can better control the flow of fertilisers and water by using crop performance technologies. Using agricultural instruments like soil scout may make irrigation operations easier.

Mobile agents can execute complicated and extensive workflow for a variety of mobile-based applications using mobile computing as the platform (MAs). Furthermore, there are still a number of difficulties in developing the best scheduling plans for several competing purposes. There are still some multi-objective workflow scheduling methods that are much more beneficial. For instance, when dealing with issues with scheduling efficiency in a real-time setting, encoding is not done by the expertise of numerous preceding experts. In this study, a Dense-M-Network (DMN) model for scheduling is suggested utilising an MA reinforcement learning framework. The network-based MA workflow is detected, and the multi-workflow optimization's completion time is assessed. Markov Chain-based weighted frequent item modelling is used for this assessment. This model allows for the study of mobile application-based workflows and the assessment of state input from diverse apps. Without taking into account past expert knowledge, the weight and frequent item set may compute the span and create correlated equilibrium among the policies in a dynamic real-time environment. Mobile computing is, generally speaking, a paradigm for handling agents in mobile networking. It is especially used to supply and utilise information services and IT resources in order to provide software, infrastructure, platforms, and applications over mobile network in a scalable and on-demand way. Mobile computing develops a hybrid application environment with data mining, cloud computing, mobile edges, and the internet by enhancing storage and processing capability over mobile terminals and giving users creative and rich functional experiences.

Additionally, mobile computing inherits the benefits and drawbacks of mobile internet and mining. Higher un-stability in Quality of Service (QoS) and larger uncertainty provision, combined with a serious security crisis in mobile networking, are caused by the openness, resource limits, and uncertainty features. How to achieve effective service composition, in particular, have emerged as hot topics in mobile computing-based research.

For the traditional Internet context, several service composition and job scheduling solutions have been expected. They are also unable to cope with the cooperation of active players in the marketplaces for mobile computing. Agent-based mobile computing models are presented to address this issue. With the help of multi-agent modelling and mobile cloud systems, As the cloud service market is closer to the commercial market's core, it is much simpler to conceive the intelligence, autonomy, and initiative of cloud entities and to forecast their independent growth.

Significant research efforts have been rewarded for using Q-learning based algorithms and reinforcement algorithms in determining near-optimal workflow scheduling with

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service-of-level (SLA) agreement constraints in recent times as novel machine learning become progressively more powerful and versatile. Multi-agent reinforcement learning (MARL) models and methods have been developed for a variety of applications, including multi-robot control, distributed load balancing, decentralised network routing, traffic control issues, and electronic auctions. However, MARL-based methods for workflow scheduling have not yet been developed.

In this study, we model a scheduling problem into a multi-criteria interaction-based weighted Markov chain and discrete events to prepare for a multi-agent reinforcement learning-based framework with Dense-Mnetwork (DMN) for multi-objective workflow scheduling aimed at minimising both the cost and the time it takes to complete a given workflow. In this case, DMN agents are given input from legacy systems like neural network heuristics and trained in a multi-agent reinforcement learning environment. Every DMN agent should take into account the rewards and actions of the other agents as well as the environment's upkeep when choosing its shared distribution action. The self-optimizing and self-learning model shown in Fig. 4.1 was used to create the resulting workflow scheduling schemes. The projected model has the following advantages: Agents are taught to schedule workflows with heterogeneous virtual machines (VMs) and different types of process models with variable resource configurations. Scheduling plans with multi-path workflows may be achieved with or without human interaction. Numerous process templates were used in extensive scheduling scenarios, which were then used in simulation testing using real-time data agents through mobile data. Experimental results unmistakably show that the expected model performs better than traditional ones in terms of cost optimization and manufacture span

Algorithm ReANN

From the original raw dataset, one chosen input variable is used as the input.

a processing flow

Step 1: Cleaning up the original dataset's redundant, inconsistent, and missing data in preparation for future processing.

Step 2: Divide the preprocessed dataset in a ratio of 60-20-20 amongst the train, validation, and test sets.

Step 3 involves utilising the damped-least squares approach to train the ANN model.

Step 4: Back propagate the ANN using the softmax function for the output layer and the Leaky ReLU activation function for the hidden layers.

The performance of the trained model on the validation set should be cross-validated in step 5.

Step 6: Use the test set to verify the trained, cross-validated ANN model.

Step 7: Assess the accuracy and inaccuracy of the predictions made by trainedmodels.

Step 8: Use hyper-parameter optimization to fine-tune the learned ANN model. Step 9: Return to step 3 and continue the procedure until the highest prediction accuracy and the lowest prediction error are achieved.

The results from the cloud service ThingSpeak were combined. A six-day comparison of the automated and manual watering techniques is shown in Figure 5.2.

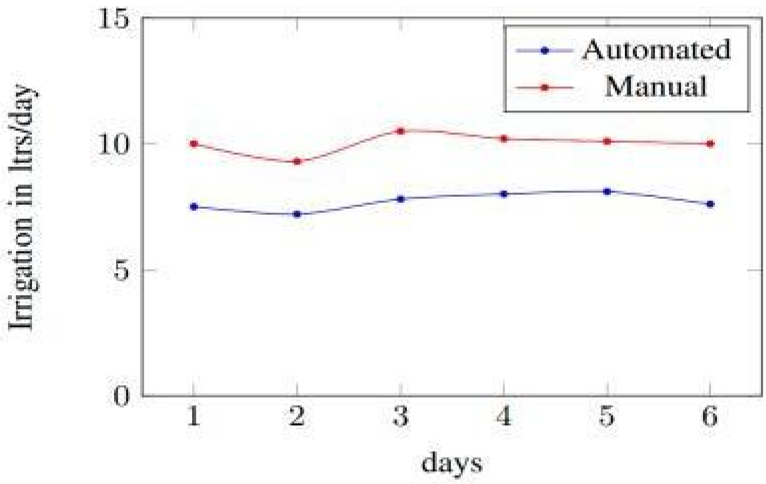


Figure 2 Automated versus manual irrigation for flow-based control

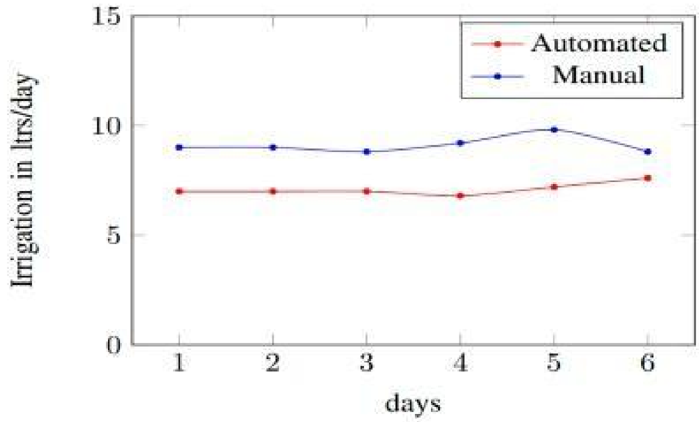


Figure 3 contrasts the simulation's optimization-based control with hand watering. Our simulations demonstrate that, in terms of water savings, optimization-based control surpasses flow-based control.

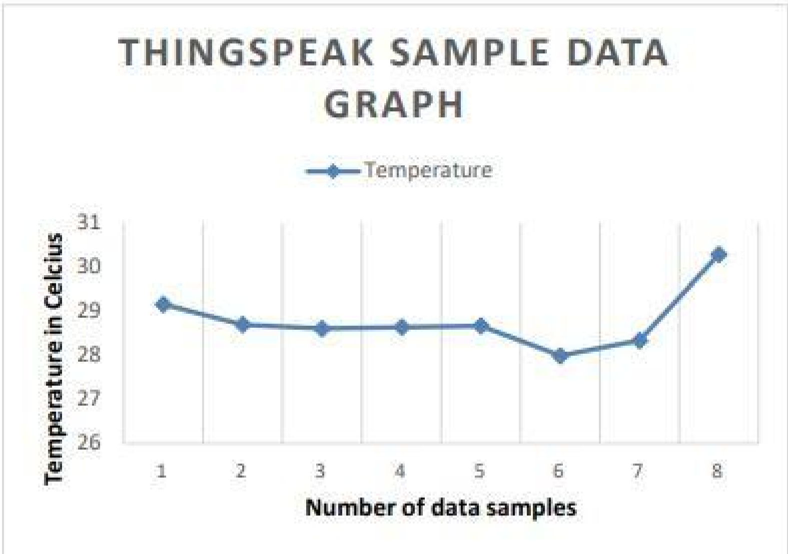


Figure.4. ThingSpeak snippet data for temperature and humidity

The findings were achieved using a single set of IoT devices for a small area of land, but several sets of IoT controllers, sensors, and actuators are needed in real time, for example, at least six sets of devices are needed for every acre of land.

## V. CONCLUSION:

This approach helps the farmer choose the right crop by providing information that most farmers do not monitor, reducing the likelihood of crop failure, and increasing yield. It also prevents companies from suffering damages. Millions of farmers around the country may utilise the system, which may be expanded to the online. The yield predictor, another subsystem that would also provide the farmer with an estimate of output if he planted the proposed crop, is being linked with the crop recommendation system as part of ongoing development. Agriculture's future growth depends on how technology like cloud computing are used with an emphasis on framer needs. The recommended solution provides a reliable and efficient irrigation technique. The ability to evaluate the data and determine how much water is required at what time of day is made possible by the regular updating of soil conditions and environmental factors.

Furthermore, the technology may effectively manage water and ensure enhanced agricultural output in dry areas with little rainfall by precisely watering the crops. The system reduces the need for humans. It enables the farmer to monitor the field and collect information on the crops, environment, and water pump from any location. In the proposed system, a novel approach may be developed to automatically water the plant and generate several harvests. Automatic detection and notification of fires is possible. A flexible regulatory framework and an enabling environment for the development of services are provided by cloud computing in the agricultural sector. This inquiry produced an automated irrigation method to decrease water use in agriculture by fusing the material in this article with an AIRA system for assisting the agricultural industry.

REFERENCES:

*1. M. Farooq and M. Pisante, Innovations in Sustainable Agriculture, Cham,Switzerland, Springer International Publishing, (2019).*

*2. T. M. Swetha, T. Yogitha, M. K. Sai Hitha, P. Syamanthika, S. S. Poorna,and K. Anuraj, IOT Based Water Management System For Crops UsingConventional Machine Learning Techniques, 12th International Conferenceon Computing Communication and Networking Technologies (ICCCNT),(2021), 1-4.*

*3. F. Bu and X. Wang, A smart agriculture IoT system based on deep reinforcement learning, Future Generation of Computing System, 99 (2019), 500–07.*

*4. K. P. Ferentinos, Deep learning models for plant disease detection and diagnosis, Computers and Electronics in Agriculture, 145 (2018), 311–18.*

*5. Z. Zhang, H Liu, Z. Meng, and J. Chen, Deep learning-based automatic recognition network of agricultural machinery images, computing. Electron. Agriculture, 166 (2019), 1078.*

*6. S. Abba, J. Wadumi Namkusong, J.A. Lee, and M. Liz Crespo, Design and performance evaluation of a low-cost autonomous sensor interface for a smart IoT- based irrigation monitoring and control system, Sensors, 19(17) (2019), 3643.*

*7. D. Manikandan, S. Prabhu, P. Chakraborty, T. Manthra, and M. Kumaravel, IoT- Based Smart Irrigation and Monitoring System in Smart Agriculture, In Futuristic Communication and Network Technologies, (2022), 45-56. 113*

*8. B. Deepa, C. Anusha, and P. Chaya Devi, Smart agriculture using IoT, In Intelligent System Design, 1171 (2021), 11-19.*

*9. W. Difallah, K. Benahmed, B. Draoui, and F. Bounaama, Linear optimization model for efficient use of irrigation water, International Journal of Agronomy, 2017 (2017).*

*10. H. Salem, A. E. Kabeel, E.M. El-Said, and O.M. Elzeki, Predictive modelling for solar power-driven hybrid desalination system using artificial neural network regression with Adam optimization, Desalination, 522 (2022), 115411.*

*11. D. R. Vincent, N. Deepa, D. Elavarasan, K. Srinivasan, S.H. Chaudhary, and C. Iwendi, Sensors driven AI-based agriculture recommendation model for assessing land suitability, Sensors, 19(17) (2019), 3667.*

*12. R. K. Jain, Design, and Development of IoT Based Smart Irrigation Sensing, Control and Monitoring System for Agricultural Applications, In E-business technologies conference proceedings, 1(1) (2021), 162-166.*