IJARSCT

ISSN (Online) 2581-9429

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

Impact Factor: 7.301

Volume 3, Issue 1, May 2023

IoT Enabled Greenhouse Plantation Monitoring

Francis Shamili. S[1], Rajasri. S[2], Prabha. R[3], Selvanayaki. S[4]

Assistant Professor, Department of Computer Science and Engineering[1]

Students, Department of Computer Science and Engineering[2,3,4]

Dhanalakshmi Srinivasan Engineering College, Perambalur, India

Abstract: *The demand for food has been increasing over the past six decades with the global population increase. Scientists have been finding different ways to meet this demand, such as; green revolution and genetically modified crop methods. These involve an unnatural technique to increase the yield, such as chemical fertilizers, pesticides, and modified seeds; these might be beneficial in the short term but might slowly disturb the internal body mechanism. In recent years, consumers are becoming more concerned about their food intake and prefer food with no adulteration and harmful pesticides. This has brought in the hype for a subdivision of framing, organic farming, where organic fertilizers and pesticides are used to retain the quality and nutrition values of the crop bring harvested. In organic farming, the right crop must be chosen according to the soil type and climate. This reduces the chance of pre-harvest crop losses caused by the abiotic stress in the environment, such as the soil moisture, improper irrigation, climate, and temperature. Desired conditions are provided to the crop, we can reduce the pre-harvest loss up to 35%. This paper offers a practical approach to reduce this loss by predicting what crop can be planted according to the present soil conditions and climate to prevent pre-harvest losses. The model involves a temperature and humidity sensor, a soil moisture sensor, LDR, a gas sensor, IoT, lamp and a water pump under a greenhouse environment connected with the help of a development board, Arduino Uno , and machine learning techniques.*

Keywords: Sensors, Arduino Uno and IOT

I. INTRODUCTION

Greenhouse is integrated with smart farming to improve agricultural growth management and, as a result, diverse conditions should be observed at precision agriculture. Focusing on the effect of universal food insecurity, over 60% of sub-Saharan countries are predicted to be in a state of malnourishment and yet several farming places are under drought state. The climatic condition is believed to be biannual dry seasons which is very difficult for farmers to cultivate crops due to shortage of water and poor soil fertility. Yet heavy rainfall is still a great threat for the farmers since it devastates cash crops. Use of a smart greenhouse with Artificial Intelligence to grow and protect plants in both dry and wet seasons and reduce labor-intensive human tasks and automate pervasive data analytics of daily plant status can surprisingly boost food security.

1.1 Internet of Things

IoT is the abbreviated form of the Internet of Things. IoT is a broad terminology given to every object that can relay information when connected to the network. IoT device includes every object that can be controlled through the Internet. IoT devices have become commonplace in consumer markets with wearable IoWT (Internet of Wearable Things), such as smart watches, and home management products, like Google home. It is estimated over 30 billion devices could be connected to the Internet of Things by2020. The applications of the Internet of Things in agriculture target conventional farming operations to meet the increasing demands and decrease production losses. IoT in agriculture uses robots, drones, remote sensors, and computer imaging combined with continuously progressing machine learning and analytical tools for monitoring crops, surveying, and mapping the fields, and providing data to farmers for rational farm management plans to save both time and money.• End-to-end IOT platform and cloud-based data storage play a vital role in smart agriculture systems. In IOT, sensors are the primary source of collecting the data on a large scale.

Using IOT, the data is analyzed and transformed into meaningful information. Data analytics helps in the analysis ofcrop conditions, weather conditions, and livestock conditions. In Agriculture, IOT helped the farmers in maintaining the quality of crops. Usually, the greenhouses are used for maintaining the required atmosphere for plants. This process demands manual intervention and continuous monitoring. But a smart greenhouse designed using IOT monitors and controls the climate intelligently and also reduces the requirement of manual intervention. Adoption of IOT in the greenhouse is cost-effective and increases accuracy as it eliminates human intervention. As an instance, solar power IOT sensors build inexpensive and modern greenhouses.People always required eating and drinking. For this, the development of the agriculture sector is always a priority. Useof IOT in agriculture has a big promising future. IOT is a driving force to increase agricultural production in acost-effective manner. Smart farming through IOT technologies helps the farmer in increasing the productivity and reduces the waste generation.

1.2 Machine Learning

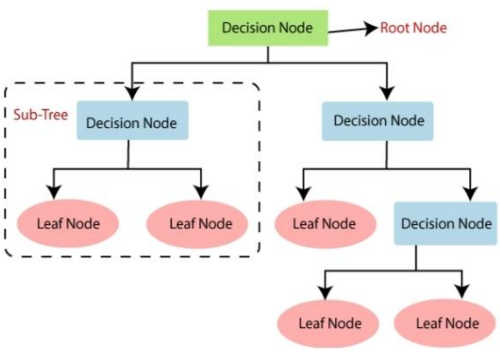
Machine learning is a branch of artificial intelligence (AI) and computer science which focuses on the use of data and algorithms to imitate the way that humans learn, gradually improving its accuracy. Machine learning is an important component of the growing fiel of data science. Through the use of statistical methods, algorithms are trained to make classifications or predictions, uncovering key insights within data mining projects. These insigy growth metrics. As big data continues to expand and grow, the market demand for data scientists will increase, requiring them to assist in the identification of the most relevant business questions and subsequently the data to answer them.

1.3 Decision Tree Algorithm

Decision Tree is a supervised learning technique that can be used for both classification and Regression problems, but mostly it is preferred for solving Classification problems. It is a tree-structured classifier, where internal nodes represent the features of a dataset, branches represent the decision rules and each leaf node represents the outcome. In a Decision tree, there are two nodes, which are the Decision Node and Leaf Node.

Decision nodes are used to make any decision and have multiple branches, whereas Leaf nodes are the output of those decisions and do not contain any further branches. The decisions or the test are performed on the basis of features of the given dataset. It is a graphical representation for getting all the possible solutions to a problem/decision based on given conditions. It is called a decision tree because, similar to a tree, it starts with the root node, which expands on further branches and constructs a tree-like structure.

1.4 Decision Tree Terminologies



1. Root Node: Root node is from where the decision tree starts. It represents the entire dataset, which further gets divided into two or more homogeneous sets.
2. Leaf Node: Leaf nodes are the final output node, and the tree cannot be segregated further after getting a leaf node.
3. Splitting: Splitting is the process of dividing the decision node/root node into sub-nodes according to the given conditions
4. Branch/Sub Tree: A tree formed by splitting the tree.

5. Pruning: Pruning is the process of removing the unwanted branches from the tree.
6. Parent/Child node: The root node of the tree is called the parent node, and other nodes are called the child nodes.

II. RELATED WORK

Hirwe Rahul Rajaram , et.al,.[1] proposed the "A Study on Green House Gas Mitigation from Solar Parks in India"IEEE-2021.Renewables are playing pivotal role in promoting sustainable development. India through its Intended Nationally Determined Contributions to United Nations Framework Convention on Climate Change has shown its commitment on mitigating Green House Gases. In February 2015, India stated its federal mission is to achieve 175 GW of Renewable Energy based capacity by the year 2022. This paper analyses the solar capacity installed through solar parks in India, corresponding power produced with prevailing solar insolations and potential Greenhouse gas abated. The current identified 20 GW solar park project with varying solar insolation of 4 - 5 kWh/m2/day has potential to produce 37155982 MWh of solar power and mitigate 34672792 tonnes of CO_2/annually. Similarly, additional 40 GW Solar park capacity being considered would generate 74311963 MWh mitigating 69345584 tonnes of CO_2 annually. Better solar suitability areas would help in enhanced solar generation by 15% more as compared to moderate and low solar areas. Capacity planned through Solar Parks would help in mitigating 1.40% and 2.81% of Greenhouse gases of the total India's emissions respectively.

Xiaoxuan Zhao Yingqi HanParallel, et.al,.[2] proposed "Control of Greenhouse Climate with a Transferable Prediction Model"IEEE 2022.Highly intelligent greenhouse without human intervention is the goal of autonomous greenhouse control. In this paper, a parallel control framework for greenhouse climate is proposed which aims to minimize the need for monitored data and expert knowledge. GreenLight climate model is used as a knowledge-based model that produces simulated data. LSTM with control units is pre-trained with these data. Test on necessary data size is done by transferring the model to other greenhouses. The new transferred model has a good improvement in the prediction of indoor temperature, humidity and CO_2 concentration with approximate 0.05, 0.05 and 0.1 of R^2 , respectively, which shows the feasibility of the transferable prediction model.

Noureddine Choab Amine Allouhi,et.al,.[3] "Effect of Greenhouse Design Parameters on the Heating and Cooling Requirement of Greenhouses in Moroccan Climatic Conditions"IEEE-2020.Protected crop production is rapidly expanding in the Mediterranean Basin, and particularly in Morocco. Increased local and overseas demand for these products led to a rapid development in greenhouse usage encouraged by government policies. The aim of this study is to investigate key design parameters that affect the thermal behavior and the heating/cooling energy need of a greenhouse situated in Agadir (Morocco). The parameters include the cladding material characteristics, shape, orientation, and air change rate. The greenhouse is modeled by a developed thermal model using TRNSYS software. The model considers the presence of the plants inside the greenhouse by adding the heat and humidity gain into the heat and water balance of the greenhouse using an evapotranspiration sub-model. The effect of evapotranspiration on the greenhouse thermal behavior was also examined in this study. A validation of the current TRNSYS simulation and evapotranspiration model was made using previous studies from the literature, and the comparison showed fair agreement. The relative error of the annually heating demand obtained by this model is 1.66%, and the evapotranspiration model used in this study shows relative deviation less than 6.5%. The results of this study indicate that the East-West greenhouse orientation is the optimum orientation as it can reduce the annual cost of air-conditioning of the greenhouse by 9.28% compared to North-South orientation. Quonset shape is the optimum greenhouse shape in Morocco as it can save 14.44% of annual cost of air-conditioning instead of the Even-span shape.

Akash Saha Priyanka Sarkar Das,et.al,.[4] Propose IllusionPIN (IPIN), a PIN-based authentication method that operates on touch screen devices. IPIN uses the technique of hybrid images to blend two keypads with different digit orderings in such a way, that the user who is close to the device is seeing one keypad to enter her PIN, while the attacker who is looking at the device from a bigger distance is seeing only the other keypad. The user's keypad is shuffled in every authentication attempt since the attacker may memorize the spatial arrangement of the pressed digits. IllusionPIN is a PIN-based authentication scheme for touch screen devices which offers shoulder-surfing resistance. The design of IllusionPIN is based on the simple observation that the user is always viewing the screen of her device from a smaller distance than a shoulder-surfer. Based on this, the core idea of IllusionPIN is to make the keypad on the touch screen to be interpreted with a different digit ordering when the viewing distance is adequately large. This way, when the shoulder surfer is standing far enough, he is viewing the keypad as being different from the one that the user is utilizing for her authentication, and consequently he is unable to extract the user's PIN. Also, the keypad is shuffled in every authentication attempt (or every digit entry) to avoid disclosing the spatial distribution of the pressed digits. We create the keypad of IllusionPIN with the method of hybrid images and we call it a hybrid keypad.

Koswatta Anupa Alsharif Faramarz, et.al,.[5] proposed "Contactless Magnetic Braking Control Unit for Small-Scaled Wind Turbines for DC Green House"IEEE-2019.This study is about to design an energy efficient, robust and contactless magnetic brake system for the small-scaled wind turbines for the DC green house. Nowadays small-scaled wind turbines usage is increasing since it is a low cost and environmentally friendly power generation method. In addition, the small-scaled wind turbines are low cost and easy to assemble. Hence, we propose these wind turbines to apply for the DC green-house. While generating the power, its brake system is vitally important to the operation of the wind turbine to give a stable electric output. Conventional wind turbine brake system uses the friction brake system to control the turbine. Our proposed braking system doesn't have any contact with the wind turbine rotor, so we believe it can be used for much longer time than the conventional wind turbines.

III. PROPOSED SYSTEM

A green house is where plants such as flowers and vegetables are grown. Greenhouses warmup during the day when sun-rays penetrates through it, which heats the plant, soil and structure. Green houses help to protect crops from many diseases, particularly those that are soil borne and splash onto plants in the rain. Greenhouse effect is a natural phenomenon and beneficial to human being. Numerous farmers fail to get good profits from the greenhouse crops for the reason that they can't manage two essential factors, which determines plant growth as well as productivity.

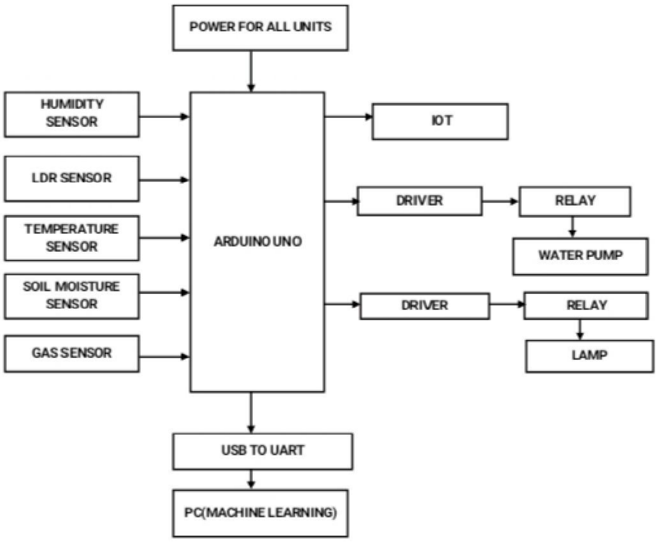
Green house temperature should not go below a certain degree, High humidity can result to crop transpiration, condensation of water vapour on various greenhouse surfaces, and water evaporation from the humid soil.To overcome such challenges, this greenhouse monitoring and control system comes to rescue. The proposed system involves monitoring the environment of a green house using multiple sensors such as temperature, soil moisture, humidity,LDR and gas sensor. The system aims to automate the process of watering plants by turning on a pump when the soil moisture level gets low.

The sensor values will be updated to the cloud to enable remote monitoring and analysis .The temperature, soil moisture, humidity,LDR and gas sensor will be connected to a Arduino or using appropriate interfaces. The microcontroller will continuously read the sensor values and store them in its memory .The microcontroller will process the sensor data and using machine learning determining whether the soil moisture level is low.and If the soil moisture level is low, the microcontroller will activate a pump to water the plants. If the LDR and gas level is low, the microcontroller will activate a lamp to give light to the plants The microcontroller will be connected to the cloud using Wi-Fi.

The sensor values will be updated to the cloud at regular intervals.The cloud will provide a web-based interface for monitoring the greenhouse environment remotely. The user can view real-time sensor values, set thresholds for alerts, and monitor the system's performance. The proposed system involves monitoring the greenhouse environment using multiple sensors and automating the watering process using a pump. The sensor values will be updated to the cloud to enable remote monitoring and analysis. The system can also send alerts to the user's mobile phone if any sensor value crosses the set thresholds.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 1, May 2023

Block Diagram:



IV. EXPERIMENTAL RESULTS

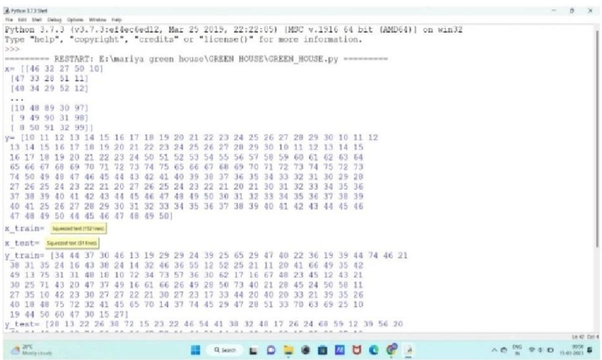
The use of DHT11 sensor, soil moisture and gas sensor, IoT technology, and a pump in greenhouse monitoring can provide several benefits, including;

Improved plant growth: By monitoring temperature, humidity, soil moisture and gas, and automating irrigation, farmers can ensure that plants receive the ideal conditions for growth, resulting in healthier and more productive crops.

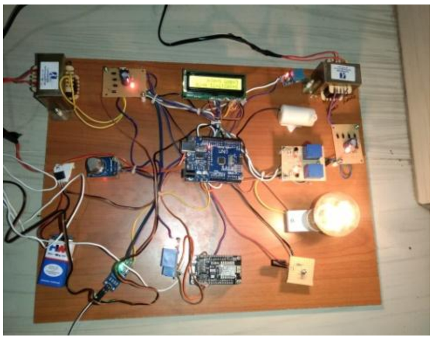
Reduced labor costs: Automating the irrigation process using a pump and IoT technology can significantly reduce the need for manual watering and monitoring, saving time and labor costs.

Increased efficiency: The use of IoT technology to remotely monitor and control greenhouse conditions can help farmers quickly identify and address any issues, minimizing the risk of crop loss and maximizing efficiency.

More sustainable practices: By optimizing water and energy use, greenhouse monitoring can help reduce waste and promote more sustainable agricultural practices.



IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 1, May 2023



V. ADVANTAGES

The greenhouse effect is a natural process that occurs in the Earth's atmosphere. It is caused by certain gases in the atmosphere, known as greenhouse gases, which trap heat from the sun and prevent it from escaping into space.

This process is essential to life on Earth because it helps to regulate the planet's temperature and keep it within a range that is suitable for life. Such as the burning of fossil fuels and deforestation, have increased the concentration of greenhouse gases in the atmosphere.

This has led to an enhanced greenhouse effect, commonly known as the greenhouse effect, which is causing the Earth's temperature.

While the greenhouse effect has some advantages, such as keeping the planet warm enough for life to exist, the enhanced greenhouse effect is causing a number of problems.

The rising temperature is causing changes in the climate, such as more frequent and severe heat waves, droughts, and storms.

It is also causing the polar ice caps to melt, which is leading to rising sea levels and the flooding of coastal areas. Therefore, while the greenhouse effect is a necessary process for life on Earth, the enhanced greenhouse effect caused by human activities is causing significant problems and needs to be addressed through reducing greenhouse gas emissions and transitioning to cleaner energy sources.

VI. APPLICATIONS

Extending growing seasons: Greenhouses can extend the growing season of plants by creating a warm and controlled environment that is independent of external weather conditions. This allows farmers to grow crops year-round, which can increase yields and profitability.

Protecting plants: Greenhouses can protect plants from pests and diseases by providing a physical barrier that prevents pests and diseases from entering the growing area. This can reduce the need for pesticides and other chemical treatments.

Improved crop yields: The controlled environment inside a greenhouse can provide optimal conditions for plant growth, resulting in higher crop yields and better quality produce.

More efficient water use: Greenhouses can be designed to use water more efficiently by capturing and recycling water that is lost through transpiration.

Sustainable agriculture: Greenhouses can be powered by renewable energy sources such as solar and wind, making them an environmentally sustainable way to grow crops.

VII. CONCLUSION

The use of DHT11 sensor and soil moisture and gas sensor in greenhouse monitoring can provide valuable insights into the environmental conditions of the greenhouse, which can help farmers optimize plant growth and increase yields.The DHT11 sensor can measure temperature and humidity levels within the greenhouse, allowing farmers to adjust ventilation and heating systems accordingly. The soil moisture and level sensor can monitor the water content and level of soil, ensuring that plants are receiving the appropriate amount of water.IoT technology can be used to connect these sensors to a centralized system, allowing farmers to remotely monitor and control the greenhouse environment. This can be especially useful for farmers who have multiple greenhouses or who need to travel frequently.

In addition, a pump can be installed to automate the irrigation process, based on the readings from the soil moisture and level sensor. This can help ensure that plants are receiving water in a timely and efficient manner, reducing the risk of over- or under-watering.

Overall, the use of DHT11 sensor, soil moisture and gas sensor, IoT technology,and machine learning algorithm usd to predict the values of data to send data and a pump and lamp turn on and off can help farmers optimize plant growth and increase yields in greenhouse environments.

REFERENCES

[1]. T. Folnovic, Loss of Arable Land Threaten World Food Supplies. 1466 Agrivi, London, U.K., Accessed: May 1, 2021. [Online]. Available: 1467 https://blog.agrivi.com 1468

[2]. O. Calicioglu, A. Flammini, S. Bracco, L. Bellù, and R. Sims, ‘‘The future 1469 challenges of food and agriculture: An integrated analysis of trends and 1470 solutions,’’ Sustainability, vol. 11, no. 1, p. 222, 2019. 1471

[3]. D. K. Ray, N. D. Mueller, P. C. West, and J. A. Foley, ‘‘Yield trends are 1472 insufficient to double global crop production by 2050,’’ PLoS ONE, vol. 8, 1473 no. 6, 2013, Art. no. e66428. 1474

[4]. G. N. Tiwari, Greenhouse Technology for Controlled Environment. 1475 Oxford, U.K.: Alpha Science Int.'l Ltd, 2003. 1476

[5]. Historical Background of Greenhouses. Emerald Agr. Technol., 1477 Kolhapur, India. Accessed: May 1, 2021. [Online]. Available: 1478 http://www.emerald-agri.com 1479

[6]. S. Vatari, A. Bakshi, and T. Thakur, ‘‘Green house by using IoT and 1480 cloud computing,’’ in Proc. IEEE Int. Conf. Recent Trends Electron., Inf. 1481 Commun. Technol. (RTEICT), May 2016, pp. 246–250. 1482

[7]. S. El-Gayar, A. Negm, and M. Abdrabbo, ‘‘Greenhouse operation and 1483 management in Egypt,’’ in Conventional Water Resources and Agricul- 1484 ture in Egypt. Cham, Switzerland: Springer, 2018, pp. 489–560. 1485

[8]. I. L. López-Cruz, E. Fitz-Rodríguez, R. Salazar-Moreno, A. Rojano- 1486 Aguilar, and M. Kacira, ‘‘Development and analysis of dynamical math- 1487 ematical models of greenhouse climate: A review,’’ Eur. J. Hortic. Sci., 1488 vol. 83, pp. 269–280, Oct. 2018. 1489.