Integrating IOT Equipped And AI For Optimized Water Management In Piped And Micro Irrigation System To Boost Crop Yield

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Abstract- *Next-generation smart agriculture, employing IoT technology and AI capabilities revolves around comprehensive monitoring of crucial factors like moisture, temperature and water levels.The integration facilitates real-time data collection, analysis and dissemination. Through an LCD interface and IoT connectivity farmers receive updates on the vital parameters. An alert system utilizing a buzzer promptly notifies farmers of critical information ensuring timely interventions. However challenges persist in refining these systems for seamless integration, data accuracy and cost-effectiveness.Future trends indicate advancements in sensor technology, AI algorithms and enhanced connectivity promising further optimization of smart agricultural practices. The critical review is to provide a comprehensive analysis of the current landscape of IoT-equipped and AI-enabled smart agriculture. By examining the existing literature and real-world implementations, the review aims to identify the advancements, challenges and opportunities associated with integrating IoT and AI technologies in agriculture.The shed light on the potential impact of the technologies on improving agricultural practices, resource utilization and overall sustainability. By critically evaluating the current state of smart agriculture, to review aims to contribute valuable insights for researchers, practitioners, policymakers, ultimately guiding the future development and adoption of IoT and AI in the agricultural domain.*

Keywords- IOT, Moisture sensor, Temperature sensor, Ultrasonic sensor, LCD, Water motor.

I. INTRODUCTION

The integration of Internet of Things (IoT) technology and Artificial Intelligence (AI) in agriculture has ushered in a new era of precision farming, transforming traditional practices into smart agriculture. The convergence offers a myriad of opportunities to enhance efficiency, productivity and sustainability in the agricultural sector. By deploying IoT-equipped sensors, AI algorithms and farmers can gather real-time data on soil health, weather conditions and crop status. Despite the promising prospects critical review delves into the current state of IoT-equipped, AI-enabled smart agriculture, explores the challenges faced and anticipates future trends that could shape the trajectory of this transformative field.

Internet of Things (IoT) is a technology that has been gaining momentum in various industries, including agriculture. The implementation of IoT in agriculture has revolutionized the way farmers approach their work, from monitoring crop growth to analyzing soil moisture levels. The use of IOT in agriculture is commonly referred to as Smart Agriculture or Precision Agriculture. Smart Agriculture is the use of IoT devices and sensors to optimize and improve various agricultural practices. The devices collect and analyze data, allowing farmers to make more informed decisions and optimize their operations. Some of the benefits of implementing IoT in agriculture include improved efficiency, increased crop yields, reduced water usage and lower costs. The implementation of IoT in agriculture involves the use of various sensors and devices that collect data on various aspects of farming operations. For example, sensors can be used to monitor soil moisture levels, temperature, humidity, and light levels, among other things. The data is then transmitted to a central hub where it is analyzed and processed. The farmer can access the data through a web or mobile application, enabling them to make informed decisions about irrigation, fertilization and other farming practices. One of the most significant benefits of implementing IoT in agriculture is the ability to automate certain tasks. For example, sensors can be used to monitor the moisture levels in soil, and automatically trigger an irrigation system when levels drop below a certain threshold. This eliminates the need for manual monitoring, reducing labor costs and increasing efficiency. By collecting and analyzing data, farmers can make more informed decisions about their operations, leading to increased efficiency, improved crop yieldsand reduced costs.

II. LITERATURE SURVEY

Smart Secure Sensing for IoT-Based Agriculture: Anusha Vangala , Ashok Kumar Das(2021) .Agriculture is a vital area for the sustenance of mankind engulfing manufacturing, security, traceability and sustainable resource management. With the resources receding expeditiously, it is of utmost significance to innovate techniques that help in the subsistence of agriculture. The growth of Internet of Things (IoT) and Blockchain technology as two rapidly emerging fields can ameliorate the state of food chain today. To provides a rigorous literature review to inspect the state-of-the-art development of the schemes that provide information security using AI technology. After identifying the core requirements in smart agriculture, a generalized blockchain-based security architecture has been proposed. A detailed cost analysis has been conducted on the studied schemes. A meticulous comparative analysis uncovered the drawbacks in existing research. Furthermore, detailed analysis of the literature has also revealed the security goals towards which the research has been directed and helped to identify new avenues for future research using artificial intelligence.

III. EXISTING SYSTEM

It was installed with sensors which measures the parameters of agriculture field and transfer the measured details using zigbee network. It is only applicable for short range application. The existing smart agriculture system employing zigbee networks for data transfer encounters a notable limitation in its range.Zigbee technology while efficient for short-range applications may pose constraints when attempting to cover larger agricultural fields or remote areas.The limitation restricts the scalability and reach of the system, hindering its effectiveness in monitoring extensive agricultural landscapes.

As precision agriculture often involves vast expanses of farmland, the short-range nature of zigbee communication becomes a notable drawback, necessitating consideration for alternative communication technologies that offer broader coverage and can address the spatial requirements of modern agricultural practices.

Disadvantages:

The smart agriculture system employing zigbee networks for data transfer encounters a notable limitation in its range. Zigbee technology while efficient for short-range applications may pose constraints when attempting to cover larger agricultural fields or remote areas.The limitation restricts the scalability and reach of the system, hindering its effectiveness in monitoring extensive agricultural landscapes.

IV. PROPOSED SYSTEM

Introduction

It presents an innovative solution for precision agriculture, amalgamating IoT and AI technologies to revolutionize farming practices. By deploying sensors to monitor moisture, temperature and water levels coupled with prediction algorithms.To provide farmers with real-time accurate data. The integration of an intuitive interface and IoT connectivity allows for remote access to information facilitating informed decision-making. Through continuous analysis and alerts the system empowers farmers to optimize resource usage and crop management strategies.

Advantages:

- By providing accurate and timely information, they enhance crop management, leading to increased yields and improved resource utilization.
- IoT with AI in agriculture streamline processes, reducing manual labor and operational costs.

System Architecture

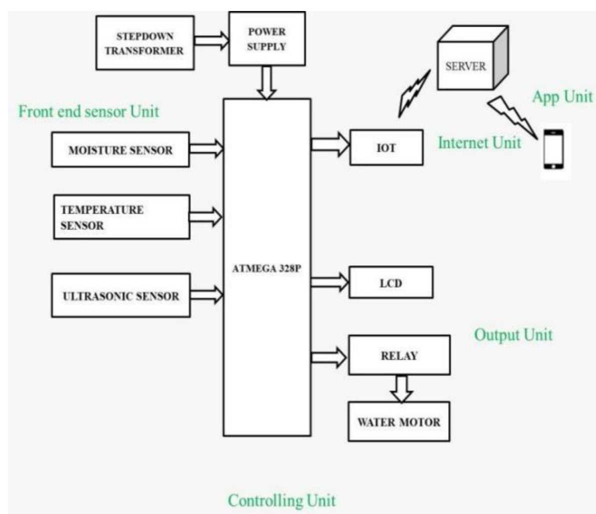

Fig.1 Overall diagram

Architecture description: The automatic irrigation system using arduino for smart crop field productivity. This consists of sensor like moisture sensor, temperature sensor,rain sensor and ultrasonic sensor. The Moisture sensor used for detecting the moisture content in soil, temperature sensor is used to measure the temperature value and ultrasonic sensor is used to measure the water level. If the excess of water in field is detectedthen motor will ON to remove it. The rain sensor detect the switching device activated by rainfall. The serve the water through on servo motor. The measured parameters are uploaded to IOT through this farmer can monitor anywhere. Based on the command from IOT water motor will ON. The measured parameters are displays on LCD.

MODULE LIST:

- Data Acquisition Module
- Machine Learning Module
- Control System Module
- User Interface Module
- Feedback loop Module

Data Acquisition Module:

It is responsible for gathering data from various sources relevant to water management in agriculture. It collects information such as weather data from local weather stations, soil moisture levels from sensors deployed in the field and crop-specific data from databases.Weather data collection is the retrieves weather data including temperature, humidity, precipitation and wind speed from weather APIs or local weather stations.Soil Moisture data collection is the acquires soil moisture readings from sensors installed at different locations in the field. Crop database integration is the accesses information about crop types, growth stages and water requirements from crop databases or agricultural research databases.

Machine Learning Module:

The utilizes machine learning algorithms to analyze the collected data and predict crop water needs. It considers factors such as weather conditions, soil moisture levels, crop type, and growth stage to generate accurate predictions. Model training is the trains machine learning models using historical data to learn the relationship between input features (e.g., weather parameters, soil moisture) and crop water needs. Model evaluation is the evaluates the performance of trained models using validation datasets to ensure their accuracy and reliability. Model tuning is the fine-tunes the machine learning models to optimize their predictive capabilities and address any shortcomings identified during evaluation.

Control System Module:

The irrigation system based on the predictions generated by the machine learning module. It automates the operation of valves and irrigation equipment to deliver the right amount of water to crops at the right time thereby optimizing water usage and enhancing crop yield.Valve control is the regulates the opening and closing of valves to control the flow of water through irrigation pipes or drip lines. Irrigation Scheduling is to determines the timing and duration of irrigation cycles based on the predicted crop water needs and environmental. Real-Time decision Making to adjust irrigation settings in response to changing weather patterns or unexpected events ensuring efficient water management.

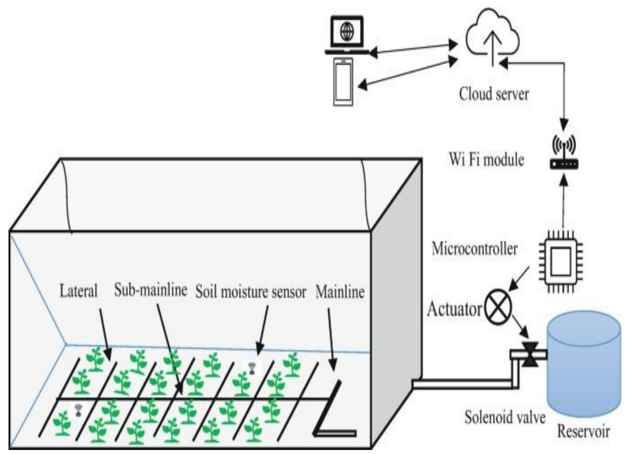

Fig.2 Set-up of the labeling chamber

User Interface Module:

It provides a user-friendly interface for farmers to interact with the system.The allows farmers to visualize data, monitor the status of the irrigation system, and adjust irrigation settings as needed. Dashboard development is the designs and develops a dashboard that displays relevant information such as weather forecasts, soil moisture levels, irrigation schedules and predictive insights.

Data visualization is to be creates visualizations such as charts, graphs and maps to present data in an intuitive and informative manner. User input handling is to Implements functionalities for farmers to input preferences, override automated decisions and interact with the system through a user-friendly interface.

Feedback Loop Module:

The continuously monitors the performance of the system and incorporates feedback to improve its accuracy and effectiveness over time. It analyzes actual outcomes compared to predicted values and adjusts the predictive models and irrigation strategies accordingly. Outcome evaluates the effectiveness of the irrigation system by comparing actual crop performance with predicted outcomes.

Fig no:3 Drip irrigation pipeline

V. CONCLUSION

The integration of IoT and AI technologies in agriculture marks a significant leap towards precision farming. The project success in monitoring crucial parameters like moisture, temperature and water levels along with accurate predictions underscores its potential to revolutionize farming practices. However while the system demonstrates promising outcomes in enhancing crop yield and resource management challenges such as refining data accuracy and cost-effectiveness persist. The research and development in sensor technology, AI algorithms and connectivity are essential to further optimize and streamline smart agricultural systems. To serves as a testament to the transformative impact of technology in creating more sustainable and productive agricultural practices.

REFERENCES

[1] R. Ullah, et al., EEWMP: an IoT-based energy-efficient water management platform for smart irrigation, Sci. Program(2021).

[2] S.K. Mousavi, A. Ghaffari, S. Besharat, H. Afshari, Improving the security of internet of things using cryptographic algorithms: a case of smart irrigation systems, J. Ambient Intell (2021).

[3] K.Y. Donzia, H.k. Kim, Architecture design of a smart farm system based on big data appliance machine learning, in: 2020 20th International Conference on Computational Science and Its Applications (ICCSA), 2020.

[4] H. Khachatryan, D.H. Suh, W. Xu, P. Useche, M.D. Dukes, Towards sustainable water management: preferences and willingness to pay for smart landscape irrigation technologies, Land Use Policy 85 (2019) .

[5] J. Miranda, P. Ponce, A. Molina, Sensing, smart and sustainable technologies forAgri-Food 4.0, Comput. Ind. 108 (2019).

[6] E. Alreshidi, Smart sustainable agriculture (SSA) solution underpinned by internet of Things (IoT) and artificial intelligence (AI) (2019).

[7] A. Gloria, C. Dionisio, G. Simoes, P. Sebastião, and N. Souto, *WSN* application for sustainable water management in irrigationsystems(2019).

[8] Baranwal, T., & Pateriya, P. K. (2016). Development of IoT based smart security and monitoring devices for agriculture. In Cloud System andBig Data Engineering (Confluence), 2016 6th International Conference(pp. 597-602). IEEE.

[9] Ryu, M., Yun, J., Miao, T., Ahn, I. Y., Choi, S. C., & Kim, J. (2015).Design and implementation of a connected farm for smart farming system. In Sensors, 2015 IEEE.

[10] Deksnys, V., et al. ”Remote agriculture automation using wireless link and IOT gateway infrastructure.” Database and Expert Systems Applications (DEXA), 2015 26th International Workshop on. IEEE,2015.