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SOIL MOISTURE AND CROP MONITORING SYSTEM FOR PRECISION AGRICULTURE USING AI & IOT

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ABSTRACT

Precision agriculture is becoming increasingly popular in the modern farming industry. Predictive analytics and improved farm and crop management systems guarantee crop quality and supply. The proposed system uses ESP32, various sensors, and a water motor to collect and analyze data related to soil moisture, crop growth rate, water level and animal intervention. The system sends real time alerts to the farmer via IOT when any abnormal condition is detected. The data collected is stored in the cloud, enabling farmers to access and analyze it for better decision making.

This paper presents the design, implementation, and evaluation of the proposed system. In this paper, we have proposed a novel methodology for precision agriculture by linking a smart sensing system through wireless communication technology. Our system focuses on the measurement of physical parameters such as soil moisture content, and environment condition of the plant that plays a vital role in precision agriculture. Furthermore, the integration of AI algorithms enhances the capabilities of the proposed system by providing advanced analytics and decision-making support.

Keywords: Smart Agriculture, AI, Real-Time Monitoring, IOT.

I. INTRODUCTION

Precision agriculture has become a popular farming technique that utilizes advanced technologies to optimize various farming processes. One of the key aspects of precision agriculture is the use of IoT-based systems that can automate and optimize various farming processes. This research aims to develop an IoT-based soil moisture monitoring, and crop monitoring system for precision agriculture. The system aims to address the challenges of water management and crop growth rate monitoring using advanced technologies. Agriculture is one of the oldest and most vital industries in the world. It provides food and resources to people all over the world. However, with the increasing population, climate change, and other environmental factors, the agriculture industry faces new challenges.IoT-based systems have emerged as a significant contributor to precision agriculture. With IoT-based systems, farmers can remotely monitor various. The farming processes, including water management, moisture level in the soil, and crop growth rate. The proposed methodology is developed with the ESP32 micro controller. The data are extracted and displayed in mobile phone through IoT technology.

A) OBJECTIVE

The objective of implementing a Soil Moisture and Crop Monitoring System for Precision Agriculture utilizing AI & IoT is to revolutionize traditional farming methodologies by integrating advanced technological solutions. This innovative system is designed to address key challenges faced by farmers, such as optimizing irrigation practices, reducing water consumption, and enhancing crop yields. By employing AI algorithms and IoT sensors, the system aims to provide real-time data on soil moisture levels, crop health, and environmental conditions. This data-driven approach enables farmers to make informed decisions regarding irrigation scheduling, fertilization, and pest management, thereby improving overall farm efficiency and productivity. Furthermore, the system facilitates remote monitoring and control, allowing farmers to access critical information and manage agricultural operations from anywhere, at any time. Ultimately, the objective is to empower farmers with the tools and insights needed to achieve sustainable agricultural practices, increase profitability, and ensure food security for future generations.

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II. LITERATURE SURVEY

The IEEE paper titled "Artificial Intelligence Technology in the Agricultural Sector" is proposed by ERSIN ELBASI , NOUR MOSTAFA , ZAKWAN ALARNAOUT, (Member, IEEE), AYMEN I. ZREIKAT. In this work due to the increasing global population and the growing demand for food worldwide as well as changes in weather conditions and the availability of water, artificial intelligence (AI) such as expert systems, natural language processing, speech recognition, and machine vision have changed not only the quantity but also the quality of work in the agricultural sector.

The IEEE paper titled"Machine Learning Applications for Precision Agriculture" is proposed by ABHINAV SHARMA 1 , ARPIT JAIN 1 , PRATEEK GUPTA2 , (Student Member, IEEE), AND VINAY CHOWDARY.In this work ,agriculture plays a vital role in the economic growth of any country. With the population, frequent changes in climatic conditions and limited resources, it becomes a challenging task to fulfil the food requirement of the present population. Precision agriculture also known as smart farming have emerged as an innovative tool to address current challenges in agricultural sustainability.

The IEEE paper titled "Design and Implementation of Online Monitoring System for Soil Salinity and Alkalinity in Yangtze River Delta Tideland" is proposed by yong liu, yun-sheng wang, shi-pu xu, wen-wen hu,ying-jing wu.In this work Soil salinity and alkalinity is an important index concerned by planting industry. In order to meet the demand of long-term observation of soil salinity and alkalinity in precision agriculture and eco-environmental protection, and to solve the current pain points of long sampling period and high cost of soil salinity measurement, this paper designs and implements an online monitoring system for soil salinity alkalinity in tideland in the Yangtze River Delta for crop planting and soil remediation.

The IEEE paper titled "Implementation of artificial intelligence in agriculture for optimisation of irrigation and application of pesticides and herbicides"is proposed byTanha Talaviya , Dhara Shah , Nivedita Patel, Hiteshri Yagnik , Manan Sha.In this work,The automation in agriculture is the main concern and the emerging subject across the world. The population is increasing tremendously and with this increase the demand of food and employment is also increasing. The traditional methods which were used by the farmers, were not sufficient enough to fulfill these requirements.

The IEEE paper titled "A Review on Agriculture Monitoring Systems using Internet of Things (IoT)" is proposed by Keene Osupile, Abid Yahya, Ravi Samikannu.In this work,As technological advancements have been introduced and utilized, there is a need to make strides in agriculture. The fundamental problem in agriculture is increasing farming efficiency and quality without regular physical monitoring to meet the rapidly expanding demand for food.

III. METHODOLOGY

Proposed method is implemented using AI for monitoring and analyse data for farmers regarding their agriculture field system.The microcontroller used in the built control system is ESP32. PH Sensor senses the low moisture content of the soil and gives a signal to the mobile application. If soil PH level is low, then relay will turn on the motor and spray the water in the plant. When the moisture content becomes sufficient, the sensor senses this and gives back the signal to the controller, Relay gets open and the water motor become turn OFF. PIR sensor is used to detect the intervention of animals in the agriculture field which affects the growth of the crop.DHT gives the value of temperature and humidity to controller, according to temperature value, motor will be turn ON or OFF. LDR measures the light intensity available and transmits data to the controller. When the temperature is high or humidity is low then buzzer will on and it will intimidate to the abnormal condition on mobile through IOT for the weather condition purpose.If any abnormalities from the original value is detected, then an alert system is produced through Buzzer.

IV. REQUIREMENT ANALYSIS

HARDWARE REQUIREMENTS

- Power Supply
- ESP32 Controller
- PH Sensor

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- LDRSensor
- DHT Sensor
- PIR Sensor

SOFTWARE REQUIREMENTS

- Embedded C
- Arduino software(IDE)

V. RESULT

The research work on "IoT-based Soil Moisture Monitoring, and Crop Monitoring System for Precision Agriculture" proposes an integrated system that utilizes IoT technology to monitor and control the water and environmental parameters of crops for precision agriculture. The system comprises various sensors, microcontrollers, wireless communication, and other components that work together to provide realtime data on the environmental conditions of crops. This system can help farmers to make informed decisions on irrigation, fertilization, and other activities, leading to more sustainable and profitable agriculture. With the use of IoT technology, farmers can reduce their water usage, minimize waste, and increase their crop yield, contributing to global food security and sustainability.

Figure 1: Crop monitoring system for Precision Agriculture

VI. FUTURE WORK

In the realm of soil moisture and crop monitoring systems, the convergence of AI and IoT presents a compelling trajectory for future exploration. Moving forward, there's considerable scope to refine predictive models, leveraging advanced machine learning techniques like deep learning and ensemble methods to enhance the accuracy of soil moisture predictions and crop health assessments. Moreover, the integration of diverse IoT sensors ranging from soil moisture probes and weather stations to aerial drones and satellite imagery offers a rich data landscape for analysis. Future endeavors may prioritize the fusion of these multi-dimensional datasets to provide nuanced insights into environmental conditions and crop dynamics. This could, in turn, inform the development of dynamic irrigation systems capable of real-time adjustments based on evolving conditions, optimizing resource usage and bolstering crop resilience. Furthermore, the application of AI-driven image analysis for early detection of diseases, pests, and nutrient deficiencies stands as a promising avenue for safeguarding crop health. In tandem, collaborative platforms can facilitate knowledge exchange and collective learning, propelling advancements in sustainable agriculture and bolstering food security in the face of a

changing climate.

VII. CONCLUSION

In conclusion, the research on "IoT-based Soil Moisture Monitoring and Crop Monitoring System for Precision Agriculture" presents a comprehensive solution to address the challenges faced by modern agriculture. By leveraging IoT technology, the integrated system offers real-time monitoring and control of water and environmental parameters crucial for crop growth and health. Through the collaboration of various sensors, microcontrollers, and wireless communication, farmers gain access to timely and accurate data, empowering them to make informed decisions regarding irrigation, fertilization, and other farming activities.

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