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IOT BASED SMART IRRIGATION WITH WEED DETECTION USING MACHINE LEARNING

Dr.V.Seedha Devi[1], Mrs.Kanimozhi .L[2],Aswin Kumar.C.J[3],Purushothaman.R[4], Shree Kumar M.B[5]

Professor, Department of Information Technology, Jaya Engineering College, Chennai, India[1]

Asst.Prof, Department of Information Technology, Jaya Engineering College, Chennai, India[2]

Student B.Tech (IT), Jaya Engineering College, Chennai, India[2,3,,4]

Abstract: The process of soil analysis involves assessing various parameters to understand the quality and composition of the soil. This includes evaluating nutrient content, moisture levels, texture among other factors. The aim is to gather comprehensive information about the soil's characteristics, allowing for informed recommendations on treatments to improve fertility and optimize agricultural practices. To further automate and optimize agricultural practices, the system incorporates a moisture sensor. This sensor measures the moisture levels in the soil and assesses the need for water. When the system determines that additional moisture is required, it automatically triggers the release of these resources (water) into the field. To enhance this soil management system, Yolo v8 algorithm are employed. This algorithm play a crucial role in identifying and classifying unwanted plants within the crop field. By leveraging advanced image recognition and analysis, the system can distinguish between desired crops and invasive or harmful plants. Once identified, the system promptly notifies users, enabling timely intervention to address these issues and maintain the health of the crops. In addition to plant identification, the system provides real-time weather updates to users. This feature ensures that farmers and stakeholders are informed about current and upcoming weather conditions.

Keywords: Soil analysis, Yolo algorithm, Real Time Weather Updates, Moisture Sensor, Automation for Agricultural Practices

I. INTRODUCTION

In IoT-based smart agriculture, the integration of IoT and machine learning technologies revolutionizes traditional farming practices. This approach involves the deployment of a network of sensors and devices throughout agricultural fields, capturing real-time data on various parameters critical to crop health and growth. These parameters typically include soil moisture levels, temperature, humidity, weather patterns, and the overall condition of the crops.

Furthermore, the IoT-based smart agriculture system allows for remote monitoring and control. Farmers can access the data and insights through mobile applications or web interfaces, providing them with the flexibility to manage their farms from anywhere. This level of connectivity and automation enhances overall operational efficiency and reduces the need for manual intervention. Detecting weeds in agriculture has been made more efficient with the YOLO v8 algorithm, known for its speed and effectiveness in real-time object detection.

The process involves gathering a diverse dataset of agricultural images, annotating them to mark weed locations, and training the YOLO v8 model. This includes pre-training on a general dataset like COCO and fine-tuning on the specific weed dataset. Configuration parameters are adjusted, and hyperparameters are fine-tuned. After training, the model can be applied to new images, providing bounding boxes around detected weeds.

Post-processing steps refine these detections, and the model can be integrated into various agricultural systems for real-time or batch analysis. Continuous evaluation ensures accurate weed detection, with opportunities for further fine-tuning based on real-world feedback. Implementing YOLO v8 enables farmers to automate weed identification, contributing to more targeted and efficient weed control in agriculture.

II. YOLO TECHNOLOGY

YOLO V8 (You Only Look Once version 8) represents the latest iteration of the YOLO family of object detection algorithms, known for their remarkable speed and accuracy. This version incorporates various improvements over its predecessors, including enhancements in model architecture, training methodologies, and optimization techniques. In the context of weed detection, YOLO V8 can effectively differentiate between various types of weeds and other vegetation,

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aidin g farmers in identifying and managing weed infestations more efficiently. By leveraging deep learning and convolutional neural networks (CNNs), YOLO V8 can analyze images with high precision, even in complex agricultural landscapes with diverse plant species and environmental conditions.

Additionally, the real-time processing capabilities of YOLO V8 enable seamless integration into automated agricultural systems, allowing for timely decision-making and targeted interventions to control weed growth. Furthermore, the adaptability of YOLO V8 facilitates its deployment across different farming practices and crop types, offering scalable solutions for weed management in both small-scale and large-scale agricultural operations. As research and development in deep learning continue to advance, YOLO V8 holds immense potential not only for weed detection but also for addressing broader challenges in agricultural sustainability and precision farming.

III. LITERATURE REVIEW

Rahul Mehetre, Shantanu kore,In this Modern industry remote monitoring and controlling equipment at farm from a long distance is challenging now a days. At present we can control the equipment with the help of smartphones using IOT. This paper presents a novel of smart agriculture system using ATmega328P with global connection using Internet of Things (IOT). Internet of Thing (IOT) plays a important role in smart agriculture system. Smart agriculture helps to reduce the farmer's work. It works automatically or farmer can operate it from anywhere. Smart agriculture monitoring system used wireless sensor network that collect all live information from different sensors and send that data through wireless protocol. Sensors that are used in system provides information about agriculture field. This project is developed to monitor crop-field using sensors.

C. N. Bhoyar, Pooja Siriya,Agriculture is becoming an important growing sector throughout the world due to increasing population. Major challenge in agriculture sector is to improve farm productivity and quality of farming without continuous manual monitoring to meet the rapidly growing demand for food. Apart from increasing population, the climate change is also a big concern in agricultural sector. The purpose of this research work is to purpose a smart farming method based on internet of things (IOT) to deal with the adverse situations. The smart farming can be adopted which offer high precision crop control, collection of useful data and automated farming technique. This works presents a smart agriculture system which monitors soil humidity and temperature.

Sanku Kumar Roy , Sudip Misra, In this article, we present the design of an Internet-of-Things (IoT)-based dynamic irrigation scheduling system (Agri Sens) for efficient water management of irrigated crop fields. The Agri Sens provides real time, automatic, dynamic as well as remote manual irrigation treatment for different growth phases of a crop's life cycle using IoT. A low-cost water-level sensor is designed to measure the level of water present in a field. We propose an algorithm for automatic dynamic-cum-manual irrigation based on farmer requirements. The Agri Sens has a farmer friendly user interface, which provides field information to the farmers in a multimodal manner—visual display, cell phone, and Web portal.

Anupuri Sai Priya, Nadimpalli Lavanya, Agriculture is one amongst the world's oldest sources of human nourishment. To satisfy the strain of an ever-increasing population, agricultural output must be greatly enhanced. People employed natural techniques to enhance production within the past, like utilising garbage as a fertiliser within the fields, which increased output sufficiently to fulfil the population's needs. Following this epoch, the utilization of lethal chemicals like herbicides skyrocketed. As a result, we've got made extra money while also causing greater environmental damage. the most important goal of this research is to use image processing to detect and take away weeds.So, in this project, we've created a way to decrease herbicide consumption by only spraying them where weeds are present. Using image processing, we were able to locate weeds in the site photos and classify them based on their area and aspect ratio.

Suryavanshi A. P, Patankar Amit Ramdas,Weeds are aggressive, need light, water, nutrients and space for crops, garden plants or lawn. Weed management usually consists of spraying herbicides throughout the agricultural sector. Most of them grow quickly and can take over many fields they are in. A rapidly developing area of research today is artificial intelligence, specifically deep learning. One of its many applications is object recognition using computer vision. This work proposes a deep learning with image processing framework for classification of various crops and weeds. A deep convolutional neural network (CNN) architecture is developed to implement this classification with improved accuracy by increasing the deep layers compared to existing CNNs.

IV. PROPOSED METHODOLOGY

This smart agriculture methods reduce the workers in the field by using sensors such as soil moisture, temperature, humidity, and light sensors to gather comprehensive data about the environment. We can integrate real-time weather data

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to make irrigation decisions based on current and forecasted weather conditions. This helps the system adapt to changing environmental factors and we can easily identify the fake crops in the field. Implement features to optimize water usage, such as automatic adjustment of irrigation levels based on plant growth stages and water requirements. We can also develop a user-friendly interface, such as a mobile app or web platform, allowing users to monitor the system remotely and adjust irrigation settings based on real-time information.

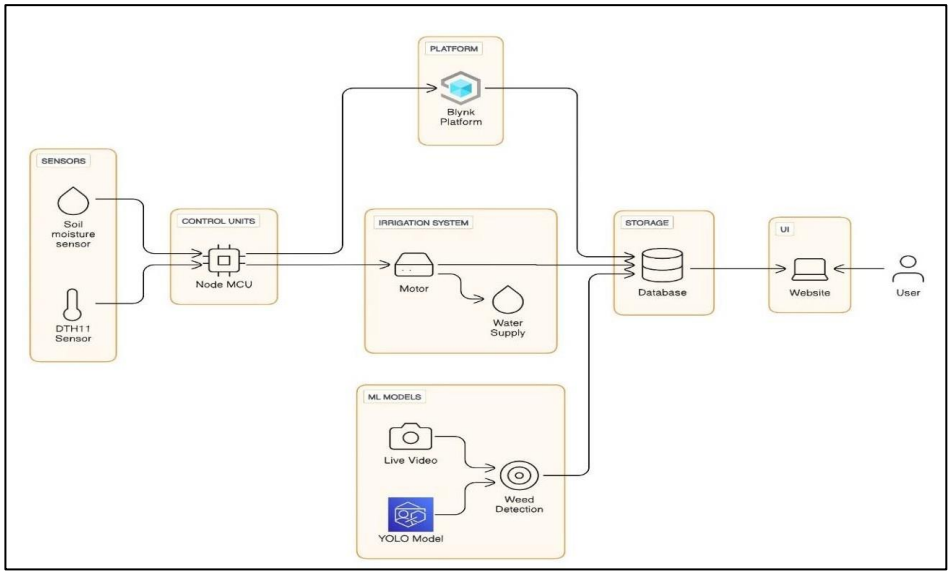

Fig. 1 System Architecture

The system consists of several sensors, including a soil moisture sensor and a DTH11 sensor, which collect data about the soil and environmental conditions. The sensors are connected to a control unit, which is a Node MCU in this case. The control unit is responsiblefor processing the data and controlling the irrigation system. The system also includes a Blynkplatform, which is a mobile and web-based application that allows users to monitor and controlthe system remotely. The platform provides a user interface (UI) for the system, which includesfeatures such as live video, water supply management, and weed detection. The weed detectionfeature uses a machine learning model, specifically the YOLO model, to analyse live video from a camera and identify unwanted plants. The system architecture diagram also shows thatthe system includes a water supply and a motor for the irrigation system. The system stores data in a database, which can be accessed and analyzed by the system administrator.

V. RESULT

Our project combines advanced deep learning for identification weed plant . With a 82.00% accuracy rate using YOLOv8, and we use the iot technologies for smart irrigation method it can identify the moisture level of soil,humidity.

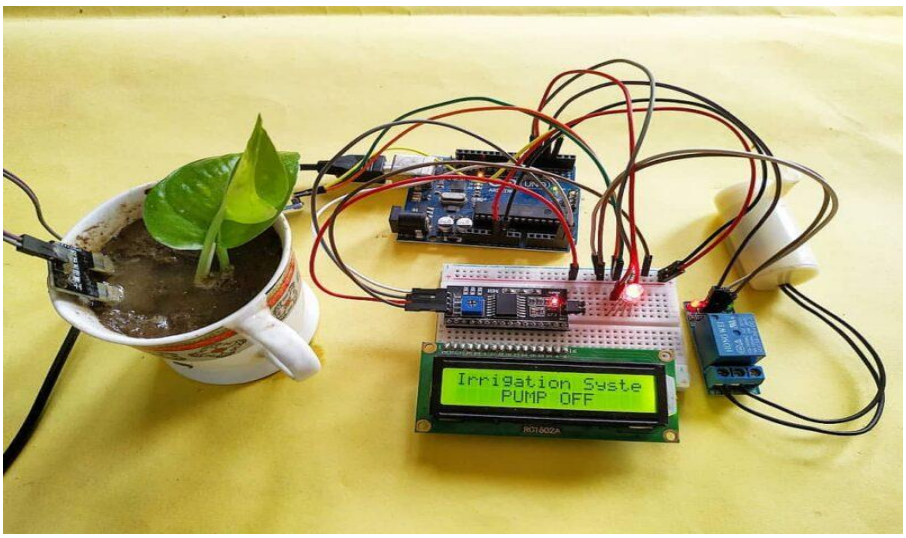

Fig 2 Smart Irrigation method

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Fig 3 Display a values of soil

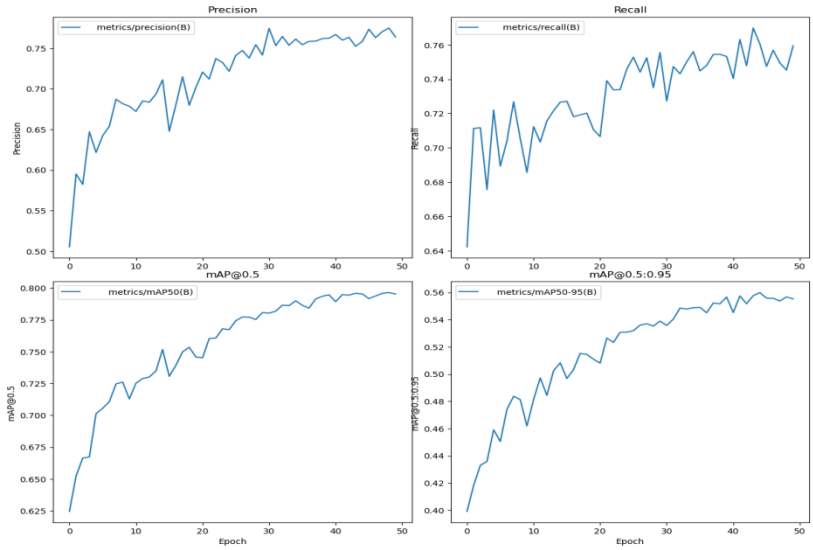

Fig 4 Result of loss and precision

Fig 5 Weed detection

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VI. CONCLUSION AND FUTURE ENHANCEMENT

In conclusion, the implementation of IoT-based smart irrigation system with integrated weed detection to support farmers in identifying unwanted crops and effortlessly monitoring sensor data. This innovative system combines advanced technology with agricultural needs, offering real-time insights into field conditions. By leveraging sensors, our system accurately detects weeds, allowing farmers to take targeted action, optimizing crop growth. Additionally, the intuitive interface enables seamless monitoring of sensor readings, providing farmers with instant access to critical information about soil moisture, humidity, and weed presence. Our goal is to streamline farming operations, empowering farmers with the tools they need to make informed decisions and maximize productivity while conserving resources.

Automated weed management integrates robotic or drone-based platforms with weed detection sensors and precision weed control mechanisms. These systems independently patrol fields, identify weeds, and apply targeted treatments. Leveraging sophisticated algorithms and sensor technology, they optimize weed control while reducing labor requirements and environmental impact, seamlessly integrating within smart irrigation systems for comprehensive field management. Augmented by cloud-based analytics and remote access, data collected by the smart irrigation system undergoes real-time processing and analysis, generating actionable insights and performance metrics accessible to farmers anytime, anywhere. With remote capabilities, farmers can monitor field conditions, adjust irrigation settings, and manage weed control operations remotely, maximizing operational efficiency and flexibility. This integrated approach empowers farmers to make informed decisions and take timely actions to optimize crop yield, minimize resource wastage, and reduce environmental impact.

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