

Pest Control and Leaf Disease Identification Mechanism Using Aiot

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Abstract— This project aims to transform agriculture through the development of A-IoT technologies. It can solve problems that can monitor important areas to achieve good plant growth and effective pest management. The system uses battery-powered sustainability and advanced image processing algorithms to continuously monitor plant health throughout the day and monitor for pests. Infrared motion sensors have also been used to monitor crops at night in the greenhouse environment. Through advanced smart algorithms, the system analyzes sensor data to identify symptoms of plant diseases and quickly alert farmers to any problems. The main aim of the project is to increase efficiency and reduce losses from pests and environmental damage through the integration of urine technology with stable energy. The convolutional neural network (CNN) algorithm is trained with up to 96.78% accuracy using the Kaggle Jupyter dataset, strengthening the performance and reliability of the system.

Keywords— AIoT, smart agriculture, crop health, pest management, battery-powered sustainability, image processing algorithms, infrared motion sensors, greenhouse environment, smart algorithms, plant diseases, efficiency, losses reduction, urine technology, stable energy, convolutional neural network (CNN)

1. INTRODUCTION

Agriculture faces many challenges, from increasing plant growth to better pest control. In response to these challenges, the development of artificial intelligence in Internet of Things (AIoT) technology holds great promise. The project aims to transform agriculture by using artificial intelligence and IoT technology to monitor important aspects of plant health and pest management. Leveraging battery-powered sustainability and advanced image processing algorithms, the system can continuously monitor plant health and sun pests. Additionally, infrared motion sensors are used to extend monitoring into the night, especially in greenhouse environments. A system that detects pests in agricultural areas and enables farmers to quickly understand threats was developed using Raspberry Pi and a camera.

Using intelligent algorithms, the system analyzes sensor data to detect early signs of plant diseases, allowing timely intervention to reduce risks. The main aim of the program is to improve agriculture and reduce damage caused by pests and the environment. The project aims to reduce environmental impact while increasing crop yields by integrating technologies such as AIoT and sustainable energy. The core software used in the project includes image processing techniques for pest detection and the use of convolutional neural network (CNN) algorithm for high-precision training using the Kaggle Jupyter dataset. These software products increase the performance and reliability of the system, allowing farmers to better understand agricultural management.

1.1 BACKGROUND

Traditionally, agricultural pest management methods are labor intensive and time consuming; It relies on manual inspections and the use of pesticides. This manual method not only incurs significant labor costs, but also poses risks to soil health and the environment due to excessive or improper use of pesticides. In addition, manual methods often cause delays in the detection of pests, resulting in increased efficiency and losses. Current systems attempt to use algorithms such as K-Nearest Neighbors (KNN) to detect pests. However, these systems tend to have low accuracy, limiting their effectiveness in accurate identification and control of pests. According to these challenges, there is an urgent need for better and more accurate pest management. Using advances in AI IoT technology such as image processing and machine learning, it is possible to create a system that can detect malware and optimize them for use. By solving these problems, the project aims to change pest management in agriculture, reduce dependence on manual labor, reduce pesticide use, maintain healthy soil and ultimately increase crop yields.

1.2 MOTIVATION

AGRICULTURE WELFARE PROGRAMS: The project is to solve important problems facing agriculture, especially in the field of pest control. This project aims to transform traditional agricultural practices, which are often labour-intensive, time-consuming and environmentally damaging, by using artificial intelligence smart and IoT technology. Motivation stems from a deep desire to improve agriculture and the environment. Sustainable development while minimizing negative impacts on the environment and human health. The program aims to increase overall crop yields by automating pesticides and optimizing pesticide application. The program has the potential to benefit the agricultural community by improving sound and accurate pest management, providing farmers with the tools and technological know-how they need to thrive in a difficult and challenging environment.

1.3 OBJECTIVE

The program aims to transform agricultural practices through the development and use of smart Internet of Things technologies. Goals include improving the accuracy of pest detection using image processing and machine learning algorithms, automating pest management to reduce reliance on manual inspection, and optimizing pesticide application strategies to reduce environmental impact. The program also focuses on integrating sensor networks for pest monitoring, improving crop health monitoring through early disease detection, and improving the user experience to ensure farmers receive actionable information and recommendations. Process performance will be carefully evaluated to ensure efficiency and reliability and promote sustainability by reducing energy costs, reducing pesticide use and protecting soil health. Ultimately, achieving these goals will revolutionize agriculture and lead to increased productivity, yields, and improved agricultural practices.

1.4 SCOPE OF THE PROJECT

To create an AI IoT-based system for plant health monitoring and pest control in agricultural areas. It combines artificial intelligence and IoT technology to provide continuous monitoring with the support of sustainable energy sources such as battery power. Infrared motion sensors are used for night monitoring, especially in greenhouses. Develop software algorithms using image processing technology and CNN algorithms for early detection of diseases and insects. Use Raspberry Pi and cameras for data collection and analysis during monitoring. These algorithms are trained using databases like Kaggle Jupyter to achieve accuracy in pest detection. The program also includes the use of a user-friendly interface to provide farmers with insight that will enable them to make informed decisions about farm management. Overall, the project aims to improve agricultural sustainability, reduce environmental impact and increase crop yields through smart integration of AIoT technology and good practices.

2. LITERATURE SURVEY

2.1 LITERATURE SURVEY

[1] "Credit Gesture managed wi-fi Agricultural Weeding robotic: a survey (2022)"

To expand AI primarily based robots powered with high precision herbicide spraying disposing of manpower. the rural weeding robot become constructed and tested underneath normal external discipline like situations for demonstration. The running of the arm is repetitive and so the rover movements and removes the weed in the discipline. The tool designed is designed to do away with the weeds from the ploughed land routinely in a clean manner i.e., no manpower required.

[2] "Faraway area Plant sickness Detection the usage of photo Processing-A survey (2021)" Authors: Sabah Bashir, Navdeep Sharma. Authors present ailment detection in Malus domestic through an effective method like ok-mean clustering, texture and color evaluation. to classify and apprehend specific agriculture it uses the texture and shade feature the ones typically appear in regular and affected areas. In coming days, for the motive of class ok-manner clustering, Bayes classifier and important factor classifier also can be used..

2.3 INFERENCE OF THE LITERATURE REVIEW

[1] Comparative analysis of machine learning techniques: The reviewed studies emphasize the importance of comparing and evaluating the performance of different machine learning algorithms for pest identification. Various algorithms, such as logistic regression, decision trees, random forests, support vector machines, and neural networks, have been explored and compared in terms of their predictive accuracy and robustness.

[2] Challenges and future research directions: The literature acknowledges challenges. Photograph Acquisition and Pre-processing, picture Segmentation, function Extraction, photo type. The device gives desirable outcomes but has a number of scope for development. The design may be further optimized to in shape the desires of farmers and offer most vicinity insurance on the equal time. The control mechanism for the delta arm may be made greater precise and hence improving its precision.

3. SYSTEM DESIGN

3.1 OVERALL ARCHITECTURE

The overall architecture is meticulously crafted to usher in a new era of agricultural innovation. At its core lies a sophisticated network of sensors, including cameras and infrared motion detectors, strategically placed to capture comprehensive data on plant health and pest activity. This sensory input is then channeled through a robust data processing and analysis pipeline, where state-of-the-art image processing techniques and convolutional neural networks (CNNs) work in tandem to extract meaningful insights. The integration of artificial intelligence and IoT technologies ensures continuous monitoring and swift, data-driven responses to emerging threats. Sustainability is prioritized through the utilization of battery-powered systems, ensuring uninterrupted operation even in remote agricultural settings. A user-friendly interface provides farmers with intuitive access to real-time data, empowering them to make informed decisions and take timely actions. Furthermore, communication channels enable the delivery of alerts and reports, keeping farmers informed and proactive in managing their crops. Continuous refinement through training and optimization ensures that the system evolves to meet the ever-changing demands of modern agriculture, promising improved crop yields and environmental stewardship.

- **Sensors and Data Collection:** A variety of sensors, including cameras and infrared motion sensors, are placed in fields or greenhouses to collect information about plant health and pests. These sensors are connected to a central processing unit (e.g. Raspberry Pi) to collect data
- **Data processing and analysis:** Uses image processing technology and convolutional neural network (CNN) algorithms to process and analyze collected data. This step involves identifying patterns from sensor data that indicate disease or pest infestation

- **AIoT Integration:** Integration of artificial intelligence and Internet of Things (IoT) technology to monitor plant health and pests. This integration ensures that the system can respond immediately to any detected problem
- **Data Training and optimization:** Methods used for data analysis are constantly trained and optimized using data such as the Kaggle Jupyter dataset. This ensures high accuracy in identifying pests and diseases, thus increasing time efficiency
- **Communication and Reporting:** The system will include communication and reporting capabilities that will enable farmers to receive notifications or alerts via e-mail, SMS about problems found and recommendations made.

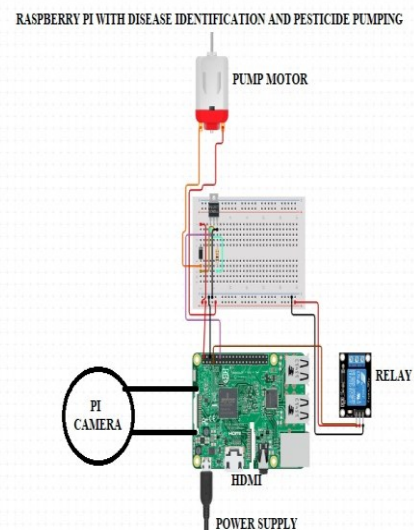


Fig 2.1 overall architecture

3.2 MODULE DESCRIPTION

The Raspberry Pi system includes several modules for plant pest monitoring. The Image Capture Module captures images of plants, controlling camera settings and managing image storage. The Image Processing Module processes captured images to identify potential pests or anomalies, using machine learning algorithms. The Pest Detection Module uses machine learning algorithms to analyze features extracted from images and detect pests. The Decision Making Module processes pest detection results and environmental data to make informed decisions regarding pest management interventions. The Control Module controls the activation of the pesticide pump and other actuators based on decisions made by the Decision Making Module. The User Interface Module displays real-time images, pest detection results, and intervention status on a graphical user interface. The Data Logging Module logs all relevant data for analysis and record-keeping. The Configuration Module allows users to customize system parameters, thresholds, and settings to adapt to specific crop types, regions, and environmental conditions.

Image Capture Module:

This module is responsible for capturing images of plants using the camera attached to the Raspberry Pi. It controls the camera settings, such as resolution, exposure, and focus, to ensure clear and high-quality images.

Image Processing Module:

The Image Processing Module processes the captured images to identify potential pests or anomalies. It employs various image processing techniques to enhance image quality and extract relevant features for analysis. Applies filters and algorithms to identify regions of interest (ROI) that may indicate pests or plant diseases.

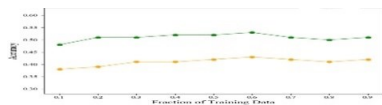
Pest Detection Module:

This module utilizes machine learning algorithms, such as convolutional neural networks (CNNs), to analyze the features extracted from the images and detect pests or signs of pest infestation. Trains and fine-tunes CNN models using labeled datasets to recognize different types of pests and symptoms. The Decision Making Module processes the pest detection results and environmental data to make informed decisions regarding pest management interventions.



Training and Testing:

In this module, 50% data is taken for testing and rest of them for training. The training data is fed to machine learning algorithms (Logistic Regression, Convolution Neural Network) and Every model is tested with the data split for testing accordingly. The model which is performing well is selected to go for further process. Evaluate model performance using appropriate metrics (e.g., accuracy, precision, recall, F1-score).



Model Development:

The module controls the activation of the pesticide pump and other actuators based on the decisions made by the Decision Making Module. This module logs all relevant data, including captured images, pest detection results, intervention actions, and environmental parameters, for analysis and record-keeping. Stores data in a structured format, such as databases or log files, for easy retrieval and analysis. Supports data export and integration with external analytics tools or platforms for advanced analysis and reporting. The Configuration Module allows users to customize and configure system parameters, thresholds, and settings to adapt to specific crop types, regions, and environmental conditions.

Deploying on a raspberry pi os:

In this module the best classifier model is deployed to predict the loan approval process The User Interface Module provides a user-friendly interface for farmers to interact with the system, monitor plant health, and receive notifications.

Data deployment:

The project deploys the best model as a web application using Raspberry pi and Python libraries that allows users to get a pests in a plant and identify the disease in a plant was an explanation for farmers.

COMPONENTS USED	FOR THIS PROJECT
MONITORING TASK	IR sensor, camera
PROCESSING	Raspberry Pi 3B
AI-TRAINING	CNN
OUTPUT	Prompt, Motor

FLOW CHART

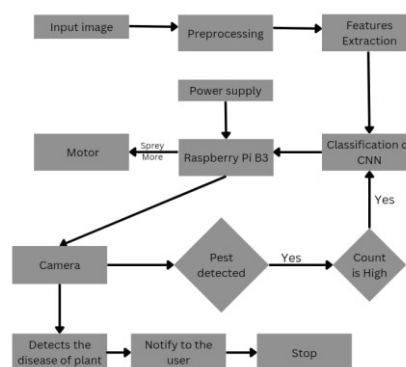


Fig 3.1 flow chart of overall system

3.2.1 FLOW CHART EXPLANATION

The architectural project was carefully designed to usher in a new era of agriculture. At its core is a network of sensors including cameras and infrared motion detectors designed to collect information about the health of plants and pests. Understanding this theory is then run through powerful data processing and analysis pipelines, where the state visualization process and connections between neural networks (CNN) work together to deliver valuable information. The combination of AI and IoT technology enables continuous monitoring and rapid, data-driven responses to emerging threats. Prioritize safety with the use of electric batteries to ensure uninterrupted operation even in remote agricultural areas. Additionally, the network can send messages and notifications to help farmers recognize and manage their products. Continuous improvement through training and optimization to ensure the process continues to evolve to meet changes in modern agriculture as well as crop improvement toilet and environmental management.

REFERENCES

- [1] “DingJu Zhu, LianZi Xie, BingXu Chen d, JianBin Tan, RenFeng Deng, Yongzhi Zheng, Qi Hu, Rashed Mustafa, Wanshan Chen, Shuai Yi, Kai Leung Yung, W.H.Andrew, IOT, 21, April (2023).
- [2] Nagar Harshith, R.S.Sharma, Internatinal Conf on Computer Communication and Informatics ICCCI-2021, Jan (2021).
- [3] P. Patil Archana, B. Shelar Abhay, M.Gawande Sagar, Int J Eng Tech(IRJET), 7, June (2020).
- [4] P. Sarikabuta and S. Supratid, "Impacts of Layer Sizes in Deep Residual-Learning Convolutional Neural Network on Flower Image Classification with Different class sizes", 2022 International Electrical Engineering Congress (iEECON), pp. 1-4, (2022).
- [5] L. Wei and K. Shudo, "Dynamic Computing Resources Allocation for Multiple Deep Learning Tasks", 2021 IEEE International Parallel and Distributed Processing Symposium Workshops (IPDPSW), pp. 899-905, (2021).
- [6] Y. Zhang and X. Wang, "Deep learning in agriculture: A review", Computers and Electronics in Agriculture, vol. 157, pp. 259-271, (2019).
- [7] Land Use by Hannah Ritche and Max Roser September (2019) <https://ourworldindata.org/land-us>
- [8] Nguyen Tuan Nam, Phan Duy Hung, ICCCV'18, June(2018).
- [9] Jaime D.L. Caro, Michael Jason Y. Benedicto, Jose Mari H. Catipay, Michael T. Garcia, Kei O. Shirabe, 2019 10th International Conf on Information, Intelligence, Systems and Applications IISA, July (2019).
- [10] Timothy Flynn, Hady Salloum, Helen Hull-Sanders, Alexander Sedunov, Nikolay Sedunov, Yegor Sinelnikov, Alexander Sutin, David, IEEEI, (May 2016).
- [11] Priya, S.Shanmuga, L. Marry gladance, A. Valarmathi and J.Maria Snowlin Joy, Test Eng. Manage., 82, February (2020).
- [12] L. Zhu and Z. Zhang, "Insect recognition based on integrated region matching and dual tree complex wavelet transform," Journal of Zhejiang University-SCIENCE C (Computers & Electronics), 2011.
- [13] R. K. Samanta and I. Ghosh, "Tea insect pests classification base on artificial neural networks," International Journal of Computer Engineering Science, vol. 2, June 2012.
- [14] Sampling insect pests, their damage and beneficial organisms Philippine rice self-sufficiency plan (PRSSP). [Online]. Available: http://pinoyrkb.com/main/resources/publications-and-figures/rice-science-for-decisionmakers/doc_download/517-sampling-insect-pests.
- [15] Resource Manual on Integrated Production and Pest Management (IPPM) in Rice, World Education (INGO) Philippines, Inc., 2005, ch. 6, pp. 113-115.
- [16] M. K. Alsmadin, K. B. Omar, S. A. Noah, and I. Almarashdeh, "Fish recognition based on robust features extraction from color texture measurements using back-propagation classifier," Journal of Theoretical And Applied Information Technology, 2010.
- [17] A. Carino, P. E. Kenmore, and V. A. Dyck, "A FARMCOP suction sampler for hoppers and predators in flooded rice fields," The International Rice Research Newsletter, vol. 4, ch. 5, pp. 21-22, 1979.