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Device To Check Harmful Chemicals and Diseases In Fruits And Vegetables Using IoT And Machine Learning

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Abstract: The project "Smart IoT-Based Fruit Chemical and Disease Detection Using Machine Learning" aims to enhance the efficiency of fruit quality assessment and disease detection through a multidimensional approach. Leveraging image-based detection and gas sensor technology, the system employs machine learning algorithms to analyse visual data and chemical emissions. The image-based detection utilizes computer vision techniques to identify visual cues associated with fruit diseases, while the gas sensor component focuses on chemical signatures emitted by fruits. By integrating these features into an IoT framework, the system provides real- time monitoring and analysis, allowing for early detection of diseases and chemical anomalies. Apart from just ensuring the accuracy of fruit quality assessment but also facilitates prompt intervention and decision-making in agricultural practices, contributing to improved crop yield and overall sustainability.

Keywords: Disease, Chemical detection, IoT, Machine learning

I. INTRODUCTION

In contemporary agriculture, precision and efficiency are crucial for ensuring optimal crop yield and quality. The integration of Internet of Things (IoT) technologies with machine learning has emerged as a transformative solution to address these challenges. This project focuses on revolutionizing fruit quality assessment and disease detection by employing a sophisticated approach that combines image-based analysis and gas sensor technology within a smart IoT framework. The system aims to provide real-time monitoring, early detection of diseases, and chemical anomalies, thus empowering farmers with timely and actionable insights to enhance agricultural productivity.

The agricultural sector is crucial for maintaining global food security, and requiring technological advancements to effectively address the evolving challenges faced by farmers. Traditional methods of fruit quality assessment and disease detection often fall short in terms of accuracy and speed. The intersection of IoT and machine learning offers a promising avenue to revolutionize agriculture by enabling precision farming practices. In this context, the project dives into the domain of smart agriculture, leveraging cutting-edge technologies to create a comprehensive solution for fruit quality assessment. By integrating image-based detection and gas sensor technology, the project aims to overcome existing limitations, fostering a more resilient and sustainable agricultural ecosystem. This introduction provides a platform for investigating how the proposed system will enhance agricultural practices and improve the overall welfare of farming communities.

II. PROBLEM STATEMENT

The agricultural sector faces a pressing challenge in the timely and accurate assessment of fruit quality and the early detection of diseases, impacting crop yield overall far sustainability. Conventional methods often lack the precision required for identifying subtle visual cues associated with diseases, and chemical anomalies go undetected until they manifest visibly. This project meets the urgent demand for a sophisticated, unified solution by harnessing the capabilities of IoT and machine learning.

The lack of a unified system integrating image-based detection and gas sensor technology leads to delays in addressing potential threats, limiting farmers' decision- making abilities. This project seeks to overcome this challenge by creating an intelligent IoT platform for immediate monitoring and analysis. It aims to empower farmers with timely insights to proactively manage diseases and maintain the quality of their fruit crops.

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OBJCETIVES:

1. Develop a robust IoT framework for real-time monitoring of fruit quality and health parameters.
2. Implement image-based detection using machine learning algorithms for early identification of visual cues associated with fruit diseases.
3. Integrate gas sensor technology to analyse chemical emissions and detect anomalies in fruit composition.
4. Enable seamless communication between the IoT devices for efficient data exchange and decision- making.
5. Empower farmers with actionable insights for timely intervention, contributing to improved crop yield and sustainability in agriculture.

MOTIVATION:

The motivation behind this project stems from the urgent need to revolutionize traditional agricultural practices by harnessing the transformative potential of modern technologies. The current challenges faced by farmers in fruit quality assessment and disease detection demand innovative solutions that can enhance efficiency and precision. By integrating smart IoT technology with advanced machine learning algorithms, this project seeks to empower farmers with real-time, data-driven insights. The motivation lies in providing a comprehensive tool that can revolutionize fruit farming practices, enabling early detection of diseases and chemical anomalies through image-based analysis and gas sensor technology. Ultimately, the project aims to contribute to increased agricultural productivity, reduced losses, and a sustainable future for farmers, aligning with the broader goals of leveraging technology to address critical issues in the agricultural sector

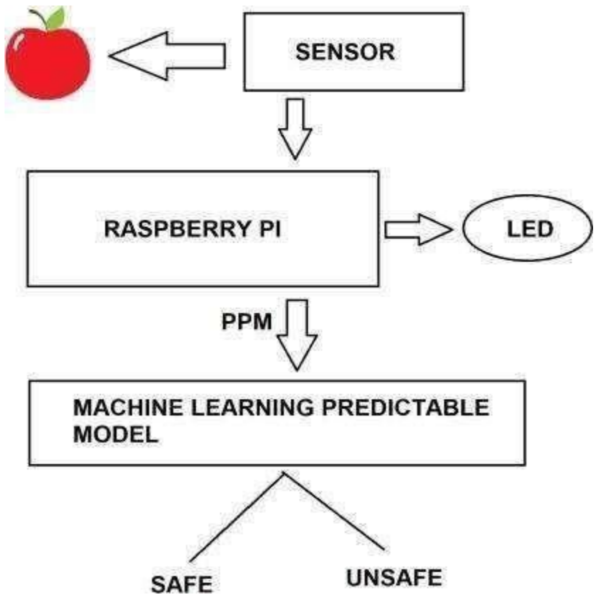
III. LITERATURE SURVEY

A literature Survey involves reviewing existing scholarly work, research papers, articles and other source related to a specific topic. The table encompasses crucial details are vital net the study, author(s), publication year, research objectives, and key advantages and disadvantages identified in each work.

2.1.1 Detection of adulteration of Fruits using IoT

A method using IoT technology has been devised to detect formalin in food products, particularly fruits and vegetables, employing machine learning techniques. This involves connecting a Grove HCHO gas sensor, capable of detecting formaldehyde concentrations up to 1 ppm, to a Raspberry Pi3. The sensor's output voltage is directly proportional to the formalin concentration in the sample. After detection, different voltage drops are recorded for various fruits due to their distinct resistances.

Initially, a rule-based classification model categorizes the fruit type based on extracted features from the dataset. Subsequently, various machine learning algorithms are employed for classification, distinguishing between naturally occurring and artificially added formalin. The system outputs predictions indicating whether a fruit is 'safe' or 'dangerous'. However, it's worth noting that this method requires expensive hardware components.



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Disadvantages: Costly hardware components are required to detect the formalin.

2.1.2 Analysis of Diseases in Fruits using Image Processing Techniques.

This study examines diseases occurring in harvested fruits, emphasizing the efficiency of automated disease detection compared to manual methods. It also addresses the issue of image distortion by detailing denoising mechanisms. Diseases affecting fruits are listed in the accompanying figure.

Notably, blight exhibits the highest standard deviation, indicating its prevalence among various fruit types. To combat such diseases, distorted leaf images are analyzed using image processing techniques like pre-processing and singular valued analysis to enable early disease detection. However, it's important to note that image processing can be expensive, depending on the system and number of detectors needed.

DISEASE	Mean	Mode	S.D
Phomopsis	35	35	3.5
Blight	37	36	4.32
Alternaria Blight	25	26	2.40
Soft rot of potato	-	-	-
White Rust of Amaranthus	14	14	2.45
Anthracnose of Chilli	14	14	1.15
Anthracnose of bottle Guard	11	11	0.94
Step rot of mango	-	-	-
Step rot of guava	26	26	1.76
Step rot of Litchi	19	19	2.00
Rust of Bean	24	24	3.0
Rhizopus rot of jack fruit	-	-	-
Alternaria blight of cauliflower	21	21	1.76
Anthrancose of Amaranthus	15	15	3.05
Scab of lemon	11	11	0.94
Sigatoka of banana	24	24	1.15
Panama of banana	19	19	1.33

Fig. 2.4: Highlighting diseases associated with fruits

Disadvantages: Image processing is very costly depending on the system used and the number of detectors required.

2.1.1 Fruit Disease Classification and Identification using Image Processing.

The fruit industry is the largest sector in India, but due to inadequate maintenance and manual inspection, diseases significantly reduce yield and quality. Manual inspection is laborious and time-consuming, prompting the proposal of an image processing approach for identifying and categorizing apple fruit diseases based on color, texture, and shape features.

The process involves segmentation, feature extraction, and feature combination, culminating in disease classification using multi-class support vector machine (SVM). The framework, depicted in Figure 2.7, outlines these steps. Initially, defect segmentation is crucial to ensure accurate disease classification, achieved through K-means clustering to isolate infected areas of the apple fruit image.

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Feature extraction then captures relevant information from the image, while feature combination consolidates color, texture, and shape features into a single descriptor for training and classification. However, it's noted that SVM yields lower accuracy compared to convolutional neural networks (CNN).

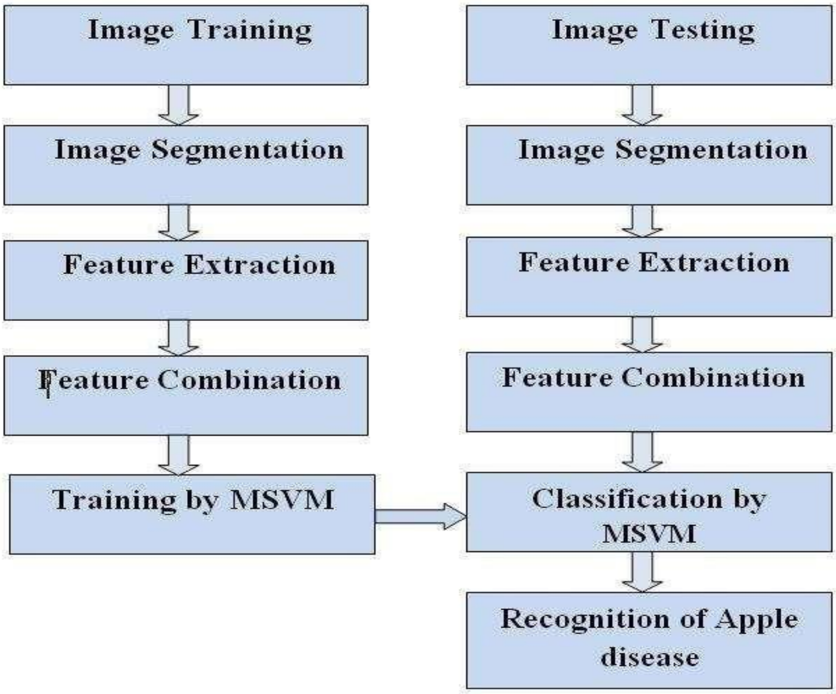

Fig. 2.7: Framework for fruit disease classification

Disadvantages: The SVM gives lesser accuracy than CNN.

2.2 BLOCK DIAGRAM AND METHODOLOGY:

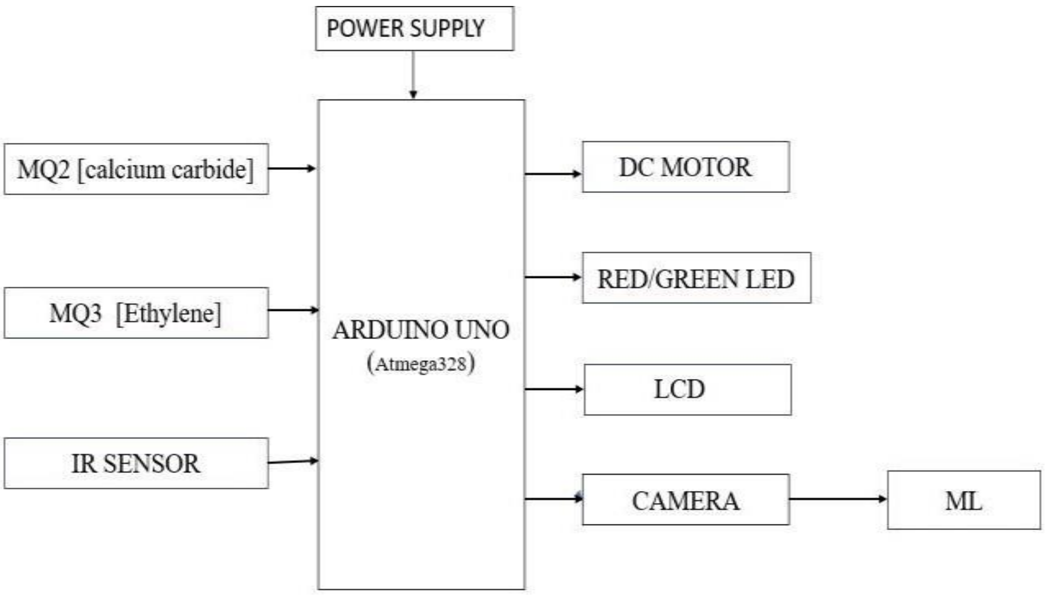

FIG 1. BLOCK DIAGRAM

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The system is develop using Dht11 and Gas sensor has used to find the chemical values and continuously collecting values and send to the Arduino. The proposed method uses Arduino which comes with cheap and best. With the help of the values the system finds chemical percentage present on the fruits and vegetables.

Working principle of the model can be understood easily. It gives clear values on the LCD than existing system. The Arduino is employed to unendingly monitor the values from all the sensors. The dht11 sensor is employed to induce the wetness and temperature of the thing. Two different kinds of fruits (fresh, decayed) have been identified with different humidity and temperature

IV. CONCLUSION

The detection of chemicals and diseases in fruits and vegetables is indispensable for safeguarding public health and ensuring the integrity of the food supply chain. By leveraging technological innovations, implementing sustainable practices, and fostering collaboration among stakeholders, we can address emerging challenges and meet evolving consumer demands.

Moving forward, continued investment in research, regulatory frameworks, and consumer education will be essential to creating resilient and transparent food systems that benefit both people and the planet

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