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Advanced Food Safety through IoT: Real Time Monitoring

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Abstract: *Diseases in fruit and vegetable cause devastating problem in economic losses and production in agricultural industry worldwide. In this project an adaptive approach for the identification of fruit diseases and vegetable is proposed and experimentally validated. In this project, this approach will be detecting the diseases which affect the fruits and can even identify some types of diseases which attacks fruits based on some comparisons. On account of that, the approach is using CNN(Convolutional Neural Networks), which is a deep learning algorithm that is where input is taken as images, and those images were differentiated based on various aspects and parameters taken from it and is most commonly applied to analyzing visual imagery. This will be definitely helpful for the farmers to enhance the growth of the crops in the mere future. For this approach, python language has been chosen for further analysis. By applying this proposed system, the accuracy level reached is 97%.*

Keywords: Deep learning, CNN, Convolutional neural network, analyzing visual imagery

I. INTRODUCTION

This project aims to leverage IoT technology to revolutionize the food safety landscape. With continuous, automated monitoring and correctivecontrol, food producers, transporters, retailers, and consumers will gain confidence in the quality and safety of food products. This not only ensures public health but also improves business efficiency and regulatory compliance, making the entire food supply chain smarter and more resilient.Food safety is one of the most critical aspects of public health. Despite advances in technology, issues such as contamination, spoilage, and improper handling still lead to foodborne illnesses and financial losses. This project aims to address these challenges by leveraging the Internet of Things (IoT) to create an intelligent, real-time monitoring and control system for food safety. Through this system, we can ensure that food is stored, transported, and handled under ideal conditions, preventing contamination and spoilage at every stage of the supply chain.This IoT-based food safety monitoring and control system will transform how food is handled across the supply chain, ensuring optimal safety conditions from production to consumption. Diseases of fruits and vegetables seriously endanger economic loss and productivity in the agriculture sector. Fruit and vegetable infections may cause a fruit's and vegetable's quality and yield to drop off too much. Monitoring the health of fruits and vegetables and determining any infections that may be present are crucial. Modern computational methods have been used in applications related to agriculture. Automatic fruit and vegetable disease detection is highly regarded in the field of agricultural information.

II. PROBLEM STATEMENT

This project aims to develop an automated system for detecting fruit quality using Convolutional Neural Networks (CNNs). Traditional methods of assessing fruit quality are often subjective and inefficient. By leveraging CNNs, we seek to accurately classify fruits into quality categories (e.g., fresh, overripe, rotten) based ontheir visual features. The goal is to create a robust model that can streamline quality control in the agricultural industry, reduce waste, and enhance consumer satisfaction.

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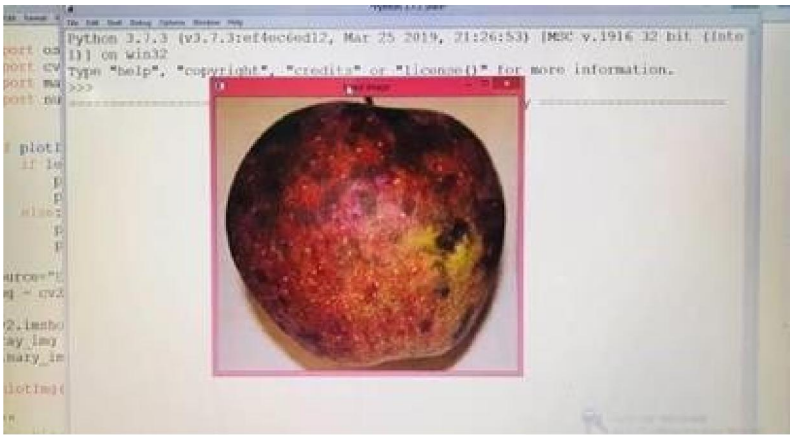
III. PROPOSED SYSTEM

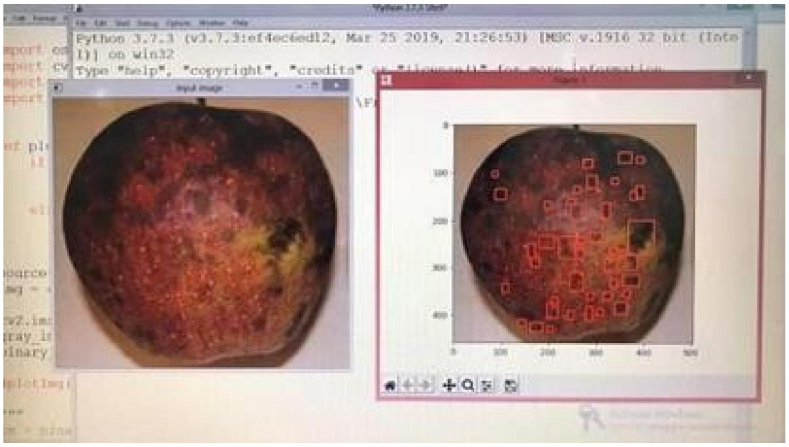
The proposed system will create a virtual mouse and keyboard that work using eye movements and hand gestures instead of physical devices. A webcam will capture the user's eye gaze to move the cursor, and a blink will be used for clicking. Had gestures will allow users to select alphabet using one finger and four finger use for swip. The system

will use computer vision and AI to recognize these movements accurately. It will be developed using Python, OpenCV to process images and gestures in real time. This hands-free system will be helpful for people with disabilities and in workplaces where physical contact with a keyboard or mouse is not convenient. The goal is to make computer interaction easier, more accessible, and mor e

IV. RESULT

Figure 1: Input image





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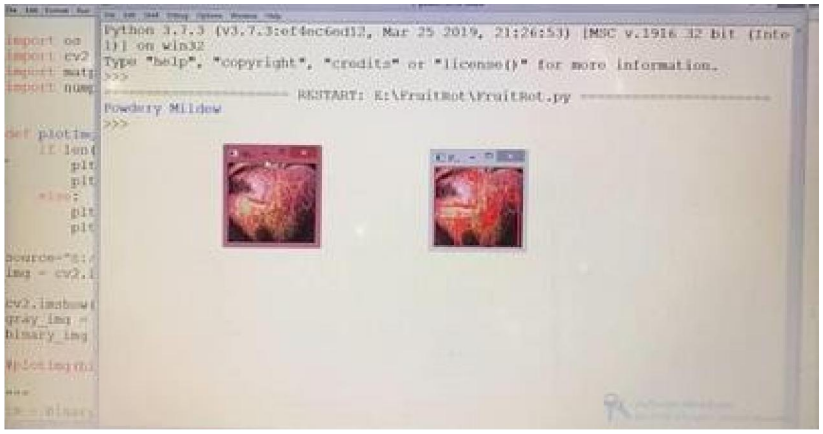

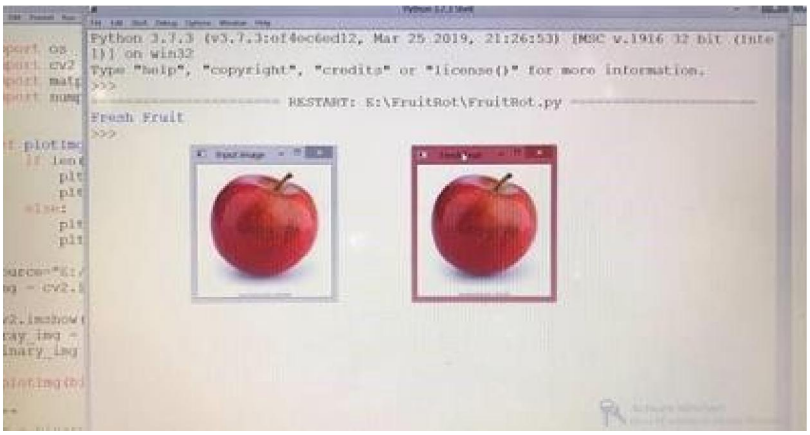

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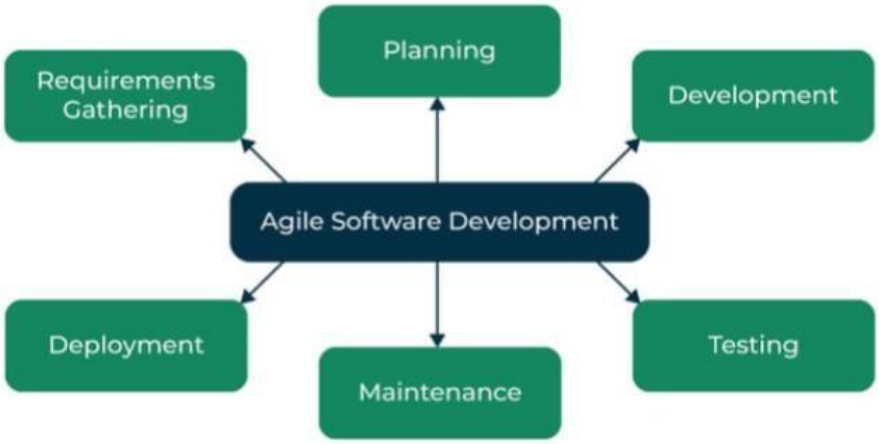

Figure 6: Agile model

V. SYSTEM ARCHITECTURE

The diagram you've provided outlines a system for **food quality detection using IoT and image classification through deep learning (CNN)**. Here's a breakdown of each component and how they work together:

Collected data is processed either locally (edge computing) or on cloud platforms. This layer analyzes the data to detect anomalies, ensure regulatory compliance, and support decision-making using AI/ML models if needed.Collected data is processed either locally (edge computing) or on cloud platforms. This layer analyzes the data to detect anomalies, ensure regulatory compliance, and support decision-making using AI/ML models if needed.Ensures secure data transmission and storage using encryption, authentication, and access control. In some cases, blockchain may be integrated for traceability and tamper-proof logging. The Internet of Things (IoT) enhances food safety by enabling real-time monitoring, data collection, and automation across the food supply chain. IoT devices like temperature, humidity, gas, and pH sensors are installed in food production, storage, and transportation environments. These devices collect critical data that is transmitted via communication networks (e.g., Wi-Fi, LoRa, GSM) to cloud platforms or edge systems.The collected data is analyzed to detect unsafe conditions such as spoilage, contamination, or temperature deviations. Automated alerts and reports help stakeholders take immediate action, reducing risks and ensuring regulatory compliance. Additionally, IoT systems support traceability, allowing food to be tracked from farm to fork, enhancing transparency and consumer trust

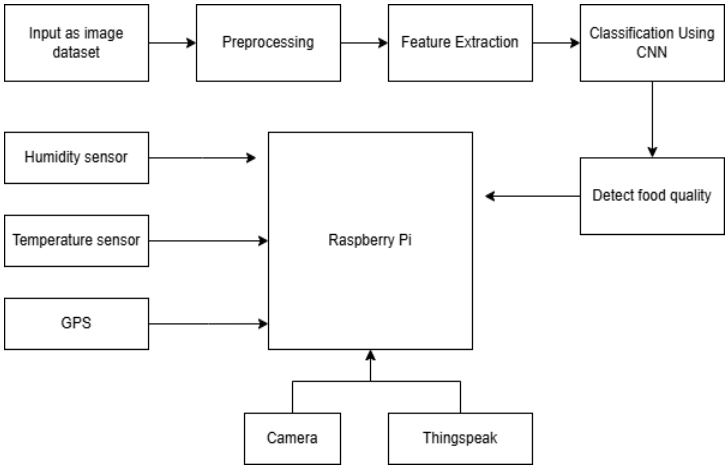

Figure 7: Architecture diagram

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1. Image Dataset Input
The system begins with an input of food images (e.g., fruits, vegetables, meat). These images are used for training and testing a classification model.

2. Preprocessing
Involves image resizing, normalization, noise reduction, and enhancement. Prepares the data for consistent and effective feature extraction.

3. Feature Extraction
Extracts key visual features such as color, texture, shape, or patterns.
Converts raw image data into numerical values suitable for deep learning models.

4. Classification Using CNN (Convolutional Neural Network)
The CNN model is trained to classify the food quality (e.g., fresh, spoiled). Based on features, it makes predictions about the food's condition.

5. Detection of Food Quality
The output of the CNN classification helps to detect whether the food is safe or not. It might categorize food into classes like "fresh", "moderately spoiled", or "unsafe".

VI. LITERATURE REVIEW

Bayu Adhi Tama, Bruno Joachim Kweka,Youngho Park, Kyung-Hyune Rhee,"A critical review of blockchain and its current applications.
Block chain technology has been known as a digital currency platform since the emergence of Bitcoin, the first and the largest of the cryptocurrencies.Hitherto, it is used for the decentralization of markets more generally, not ex-clusively for the decentralization of money and payments. The decentralized transaction ledger of blockchain could be employed to register, confirm, and send all kinds of contracts to other parties in the network.
Hadi Saleh,Sergey Avdoshin,Azamat Dzhonov "Platform for Tracking Do-nations of Charitable Foundations based on Blockchain Technology. "2019Actual Problems of Systems and Software Engineering. [17]
Donors have distrust about how donated money is spent. Currently, blockchain technology is being implemented in different sectors. Blockchain technology allows you to make the process of donations and transactions of funds trans-parent. Single platform for tracking donations that will track all information about donations, transactions and donors need to be developed.
Kriti Patidar, Dr. Swapnil Jain Decentralized E-Voting Portal Using Blockchain,",10th ICCCNT 2019 July 6-8, 2019, IIT - Kanpur,Kanpur, India [22]Online voting is an alternative to age old paper ballot system and the currently popular electronic voting machines (EVM). An electronic voting portal should offer security and integrity along with the transparency of votes and privacy of voters. This paper proposes an e-voting system based on blockchain that eliminates some of the limitations in existing voting systems. The paper also presents state of art of some blockchain frameworks for e-voting.
Ali Mansour Al-madani,Dr.Ashok T. Gaikwad,Vivek Mahale, Zeyad A.T.Ahmed,"Decentralized E-voting system based on Smart Contract by using BlockchainTechnology.",IEEE 2021.
Nowadays the use of the Internet is growing; Evoting system has been used by different countries because it reduces the cost and the time which used to consumed by using traditional voting. When the voter wants to accessthe E-voting system through the web application, there are requirements such as a web browser.
Nikhitha .m ,"Fruit Recognition and Grade of Disease Detection using In-ception V3 Model "IEEE 2019.
India, crop yield is declined due to the post-recognition of diseases in fruits by the farmers. Farmers face great economic loss worldwide. Diseases in fruits and plants are the main reasons for the agricultural loss. Knowing the

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health status of fruits/vegetables helps farmers to improve their productivity. This motivates us to design and develop a tool to help farmers detect the diseases in the early stage itself.

P. Kanjana Devi ,"Image Segmentation K-Means Clustering Algorithm for Fruit Dis- ease Detection Image Processing"IEEE 2020.

Fruit dis-eases are always considered as a remarkable issue in the cultivating business carried out across the globe. This arises the need for manual checking frame-work. In this way, agriculturists require the manual analysis of fruits. Never-theless, the continually manual watching does not provide adequate results and they generally require a heading from an expert. The world economy is pri-marily depending on the agribusiness as its development is diminishing when it has been appeared differently in relation to the expansion in intrigue and this ratio of intrigue versus creation is foreseen to be high in the upcoming years Recently, clustering and fruit image segmentation algorithms are implemented for identifying the fruit diseases.

Chen Zhichao ,"Fruit Disease Identification Based on Improved Densenet Fusion De-fogging Algorithm"IEEE 2021.

Disease is one of the main factors that threatens the growth of fruits in the field of fruit planting. This paper realized identification and control of fruit disease under complex environment through identification of fruit leaves, which plays a key role in improving yield and quality of the fruit. Basing on the above problems, this paper proposed a new type plant disease identification model basing on deep learning.

Kawaljit Kaur " Analaysis of diseases in fruits using image proccessing techniques "IEEE 2022. [21]

Agriculture plays critical part in harvesting any culture. In fact human civilization greatly depends upon agriculture. Regular Filed prevalence and water management in soil is key to achieving goal of good production.

VII. OBJECTIVE

The objective of advancing food safety through IoT is to implement a real-time monitoring and control system that ensures the safety and quality of food products throughout the supply chain by continuously tracking and managing critical factors like temperature, humidity, and contamination levels.

VIII. METHODOLOGY

Algorithm

1. Initialize Sensors

(e.g., temperature, humidity, gas, RFID)

2. Set Thresholds

(e.g., Temp < 4°C, Humidity < 60%)

3. Read Sensor Data Periodically collect data.

4. Analyze Data

Check if any value exceeds safety thresholds.

5. Trigger Alerts

If unsafe, send alert (SMS/app/email) and log event.

6. Control Actions (Optional) Turn on cooler/exhaust/fan if needed.

7. Log and Display

Store data in cloud; show status on dashboard.

8. Repeat

Continuously monitor and respond.

IX. CONCLUSION

Deep learning is a recent research technique for image processing and pattern recognition, and it can effectively solve the problems in the identification of fruit and vegetable diseases.The number of training epochs, batch size and dropout had greater influences on the respective results. The max pooling method performs much better than average pooling. In addition, the data augmentation increases the amount of training data . the data augmentation can help to improve the

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efficiency of model training. provides model support for the further development of intelligent fruit andvegetable disease..

X. FUTURE SCOPE

The future scope of a project like "Advancing Food Safety through IoT: Real-Time Monitoring and Control System" is highly promising and holds immense potential for innovation and growth. As global concerns over food safety, quality assurance, and sustainability continue to rise, the integration of Internet of Things (IoT) technologies presents numerous opportunities for transforming the food industry.

With the ability to monitor environmental conditions in real time, IoT systems can ensure food integrity at every stage— from production and storage to distribution and consumption. This not only minimizes the risk of contamination and spoilage but also allows for quick response in case of any detected irregularities.

REFERENCES

[1] Magomadov, V. S. "Deep learning and its role in smart agriculture." Journal of Physics: Conference Series. Vol. 1399. No. 4. IOP Publishing, 2019.

[2] Shi, Guobin, Rakesh Ranjan, and Lav R. Khot. "Robust image processing algorithm for computational resource limited smart apple sunburn sensing system." Information Processing in Agriculture 7.2 (2020): 212-222.

[3] Dharmasena, Tharindu, et al. "Autonomous cloud robotic system for smart agriculture." 2019 Moratuwa Engineering Research Conference (MERCon). IEEE, 2019.

[4] Tripathi, Mukesh Kumar, and Dhananjay D. Maktedar. "A role of computer vision in fruits and vegetables among various horticulture products of agriculture fields: A survey." Information Processing in Agriculture 7.2 (2020): 183-203.

[5] Sharif, Muhammad, et al. "Detection and classification of citrus diseases in agriculture based on optimized weighted segmentation and feature selection." Computers and electronics in agriculture 150 (2018): 220-234.

[6] Fiona, J. Rex, and J. Anitha. "Automated Detection of Plant diseases and Crop Analysis in Agriculture using Image Processing Techniques: A Survey." 2019 IEEE International Conference on Electrical, Computer and Communication T echnologies (ICECCT). IEEE, 2019.

[7] Kumar, Vinayshekhar Bannihatti, Sujay S. Kumar, and Varun Saboo. "Dermatological disease detection using image processing and machine learning." 2016 Third International Conference on Artificial Intelligence and Pattern Recognition (AIPR). IEEE, 2016.

[8] Singh, Vijai, and Ak K. Misra. "Detection of plant leaf diseases using image segmentation and soft computing techniques." Information processing in Agriculture 4.1 (2017): 41-49.

[9] Bakar, MN Abu, et al. "Rice leaf blast disease detection using multilevel color image thresholding." Journal of Telecommunication, Elect ronic and Computer Engineering (JTEC) 10.1 -15 (2018): 1-6.